SCIENCE

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A NATIONAL DEPARTMENT OF SCIENCE.

THE PRESENT ORGANIZATION OF THE SCIENTIFIC WORK OF THE GOVERNMENT, ESPECIALLY THAT DESIGNED TO DISCOVER AND DEVELOP THE RESOURCES OF THE COUNTRY, CONSIDERED WITH REFERENCE TO THE UPBUILDING OF SUCH A DEPARTMENT.

THE United States Government is doing more to discover the resources of its territory and to teach its people to develop them than any other government in the world. Our many noble establishments for the promotion of science, both pure and applied, are the admiration of all. Foreigners regard these institutions as the most unique feature of our government. They represent the true American idea. It is the more to be regretted, therefore, that this grand idea, so well established in our laws, is not adequately represented in the organization of the government.

The scientific work of the government is carried on by many agencies scattered through the various departments, the more important ones, however, being connected with the Treasury Department, the Navy Department, the Department of the Interior and the Department of Agriculture. Some of them are not connected with any department.

The majority of these bureaus have no logical connection with the departments to which they belong, and an investigation of their origin is necessary in order to find out how they became attached to the several departments. It usually came about in this way. Some government official became deeply interested in a certain line of scientific work bearing upon the development of the country. After agitating the matter for several years he finally secured an appropriation from Congress authorizing the investigation to be made in the de-

partment with which he was connected. Either the originator or some other friend of the scheme was put in charge of the work, and if it proved beneficial it received increased appropriations from year to year, and finally grew to be a great bureau. This method has led to some strange connections. It was in this way that the Coast Survey, the Commissioner of Navigation, the Marine Hospital Service and the Life Saving Service came to be placed under the Treasury Department, while the Navy Department controls the National Observatory, the Hydrographic Office and the Nautical Almanac. These accidental connections, once established, have usually been kept up, and so far, although they are often as disadvantageous as they are illogical, a majority of the bureaus have remained in the departments where they originated.

The time has arrived when the successful prosecution of the scientific work of the government requires that these various bureaus should be organized in accordance with a logical plan. A general coordination of all such investigations must be the next step in their development. It is proposed in this paper to suggest a plan which, it is believed, will, without injuring the work of any of them, lead to a reorganization of these bureaus and effect the necessary coordination of their researches.

The scientific agencies connected with the execution of the laws, with the construction of naval and military equipment, and with the government schools, are, of course, not included in this plan. A chemical laboratory will, for example, probably always be needed in connection with the revenue office of the Treasury Department, for the purpose of analyzing sugars, alcoholic liquors, etc. The War and Navy Departments will always need their own testing laboratories, and both the naval and military academies their extensive teaching equipments. The present discussion applies only to those agencies of the government which are designed to promote pure science or its applications to the discovery, conservation and development of the resources of the country in the broadest sense of these terms.

A rational classification of these government scientific agencies would begin with the National Observatory and the Nautical Almanac, which locate our planet in space and our country upon the globe, and supply our mariners with the data by which to sail. Next would come the Coast and Geodetic Survey, which determines the coast and boundary lines of the country and its chief heights and geographical positions. Following this would come the Geological Survey, which is charged with 'the classification of the public lands and the examination of the geological structure and resources of the national domain.' The Weather Bureau, whose duty it is to investigate our climate, and especially its relations to agriculture and other industries, would naturally come next. This would be followed by various agencies for studying the fauna and flora and determining the life zones, such as the Biological Survey, the Divisions of Entomology and of Botany, and the National Museum, including the National Herbarium.

The great economic applications of the principles elucidated by these surveys would be carried out by another group of bureaus, like the Forestry Bureau, the Agricultural and Horticultural Bureaus, and the Fish Commission. These, in turn, would be followed by other agencies organized for the purpose of investigating great economic problems, such as the forage interests of the country, the irrigation question, the industries of the arid region, and so on. Finally, the new department should include a great statistical agency, such as the proposed permanent census bureau. Statistics, showing the products of natural

forces and the results of the people's work along all lines of endeavor, form the basis of all economic science, and would be needed, therefore, in connection with the work of the bureaus above mentioned. Many of them would have to assist in collecting these data. There must, therefore, be the most intimate cooperation between the agencies of the government for the exploitation of resources and the promotion of industries, and the census bureau which measures the one and counts the results of the other.

The list appended to this paper includes the chief government scientific agencies having these, or similar objects, as distinguished from the purely executive agencies of the government. It shows that the United States government now employs 5,225 persons in this scientific and economic work, not including the census, and expends for it annually nearly eight million dollars.

A glance at this magnificent array of forces is all that is necessary to impress one, not merely with the grand initiative of the American people which has called them forth, but with their sadly divided and scattered condition; for the appended list also shows that our government is now supporting twenty-eight separate scientific bureaus, surveys, divisions or investigations, distributed among six different departments, not including fifty-four agricultural experiment stations and many other outlying agencies. Science is conducting in America a grand campaign for the advancement of civilization, but its forces are divided into so many camps that it does not win half the victories it should. What we want is an organized army, with a general staff and a commander-in-chief.

DUPLICATION OF WORK.

Scattered, as our scientific agencies are, through all the departments, organized under broad and often very indefinite laws, supervised and directed, when they receive any attention at all, by different Secretaries, usually not scientific men and always overrun with other work, there is ample opportunity for confusion and duplication of work, and consequent waste of time and money. A few illustrations will show how this works.

The government has three separate and distinct agencies for measuring the land of the country: namely, the General Land Office and the Geological Survey, both in the Interior Department, and the Coast and Geodetic Survey, in the Treasury Department. In addition to these, the Engineer Corps of the Army makes military, boundary and geographic explorations and surveys.

There are four hydrographic offices in as many departments, viz, the Hydrographic Office of the Navy, a similar office in the Coast Survey of the Treasury Department, the Division of Hydrography in the Geological Survey (Interior Department), which measures the rivers of the arid regions, and the Weather Bureau, which measures rivers and studies lake currents. These agencies are supposed to have different fields of labor, but all are liable to meet in the navigable rivers of the country.

In addition, the Fish Commission measures the waters of fishing grounds and rivers, the Engineer Corps of the Army measures the Mississippi River, the lakes and harbors. Four or five of these agencies have actually been engaged in making measurements and studies in the navigable rivers and the Great Lakes within the last few years.

The Coast Survey, the Naval Observatory and the Weather Bureau have all been engaged in recent years in studying the magnetism of the earth.

The government has at least five separate and distinct chemical laboratories in the city of Washington alone.

There are many other scientific agencies similar to those in Washington scattered throughout the country in mints, government schools, hospitals, etc., which receive appropriations for general work.

The Secretary of the Interior and the Secretary of Agriculture some time ago appointed a board to compile the laws on irrigation, and find out what each bureau of each department should do. It took this board a year to inform these two Secretaries what the law required of each of them. Its report shows that eight bureaus in the two departments must cooperate in order to accomplish any thorough work on the great problems of irrigation. Three distinct branches of the Interior Department alone are engaged in irrigation work, viz, the General Land Office, the Office of Indian Affairs and the Geological Survey. The last Census also prepared a report on this subject. The Weather Bureau and the Divisions of Soils and Vegetable Physiology of the Department of Agriculture should assist in these irrigation investigations. It is needless to say that, with so many agencies to promote irrigation, very little has been done by any of them. The Hydrographic Division of the Geological Survey deserves the credit of having done most of what has been accomplished.

Although the agricultural experiment stations receive an annual appropriation of $720,000 through the Department of Agriculture, which has an Office of Experiment Stations for compiling the results of their work, advising and assisting them, the management of their affairs is vested entirely in independent State Boards, and the supervision of the Department of Agriculture is limited at present to the reports of expenditures submitted by the station officers. Their plans of work are usually formulated by local boards or executive committees, and cover nearly all conceivable subjects connected with agriculture, horticulture and the animal industry. Only a few feeble efforts have so far been made to correlate and coordinate the investigations of these stations for the purpose of preventing duplication.

The statistics of the natural resources and the products of the country, of exports and imports, of population, schools, etc., are, in like unfortunate manner, collected and compiled by eight or ten different agencies in five or six different Departments. Besides the Census, which has collected and discussed nearly all conceivable classes of statistics, we have these agencies regularly at work: Meteorological statistics are collected by the Weather Bureau; statistics of 'mineral resources and natural products of the national domain' by the Geological Survey; agricultural statistics are collected by the Department of Agriculture; statistics of exports, imports, etc., by the Treasury Department; statistics of wages, cost of living, and industrial statistics of all kinds, are collected by the Department of Labor; statistics of transportation are collected by the Interstate Commerce Commission; statistics of fisheries are collected by the Fish Commission; and statistics of schools, colleges and universities are collected by the Bureau of Education in the Interior Department.

The same confusion exists in the practice pertaining to other lines of work. Illustrations might be almost indefinitely multiplied. But the reader must be referred to the appended list and the reports.

This duplication is the necessary result of the lack of efficient organization. Bureaus for doing the same or closely related things have been attached to many of the Departments and have remained there. Congress has been liberal to them, and they have extended their work until many of them now overlap each other. This overlapping of work is not so bad, however, as the almost total absence of cooperation.

Since the different bureaus are under different Secretaries, there is no way to enforce cooperation.

THE REMEDY.

What is needed is a general coordination of the scientific work of the government. The question is how to accomplish this. It is probable that a commission of Congress or of scientific men, while perhaps not able to reconcile all the conflicting interests involved in a general plan of reorganization, would still be productive of much good. But the first thing is for Congress to decide upon a program.

An important step was taken when the officers and employees of the scientific bureaus were put in the classified service. This renders it almost impossible to use patronage in getting appropriations or promoting legislation, and puts every man on his mettle to maintain his place by good work instead of political influence, which signifies a great deal. It is not believed, however, that much further progress can be made toward the reorganization of these bureaus and the coordination of their work until they have first been brought together under one executive head. However good their intentions and earnest their desires to do so, it is not likely that the several heads of Departments can ever agree as to the plans of scientific work which shall eliminate all duplication. Each would consult his chiefs of bureaus and be influenced by their advice, and naturally each chief will want to retain his hold upon all his former work. It is evident, therefore, that the only way to avoid duplication and waste of time and money, and to secure the proper coordination and cooperation, is to first bring all these bureaus together in one of the existing departments or in a new department.

When these bureaus have been thus brought together under the direction of one Secretary or executive head, the reorganization will be comparatively easy. It should take place naturally and gradually in the course of ordinary business. The details of this reorganization can not be considered until the new department has been formed. When this has been done the plans for the reorganization might well be left to a board composed of our leading scientific men or of the chiefs of the bureaus involved, presided over by the Secretary or some eminent scientist, appointed by him, who would act as arbitrator.

No revolutionary proceedings are advocated. The policy should be to transfer the different scientific bureaus or surveys to one department, as opportunity offers, or as the Secretaries now having charge of them find it expedient to recommend it. Let Congress once adopt a fixed policy with regard to this matter and establish it in the good opinion of the people of the country, and the rest would follow in good time. A great new department of science would thus be the result of natural development rather than of revolution, and the reorganization and coordination of the work would in the end be accomplished without injury to any scientific investigations now in progress.

It is really a wonder that our government has accomplished so much excellent scientific work through the agency of so unscientific an organization. With enormous expenditure of brain and money, it has done a vast deal for the advancement of science, but it is deplorable that so much has been wasted in doing this. We garner the golden grain of truth, to be sure, but we cut our wheat with the old-fashioned sickle, bind it with straw, thresh it with the flail, and then wait for a favorable wind to blow away the chaff. Harvested by these antiquated methods, our product costs us a great deal more than it should, and, what is worse, we lose

a large part of the grain. Shall our government not use the most improved machinery for its work? Is it not time that we had a complete scientific department for harvesting scientific truth? Such a perfect machine would garner—and garner at much less cost—a far larger harvest than the varied cumbrous appliances now in use.

CHAS. W. DABNEY, JR.

A LIST OF THE SCIENTIFIC AGENCIES OF THE UNITED STATES GOVERNMENT, ENGAGED EITHER IN THE PROMOTION OF PURE SCIENCE OR IN THE DISCOVERY AND DEVELOPMENT OF THE RESOURCES OF THE COUNTRY.

They are arrranged under the Departments with which they are at present connected. Only their chief duties, compiled from the statutes and reports, are enumerated. The amounts of money appropriated for their expenses for the fiscal year ending June 30, 1897, and the total number of employees connected with each, are added.

IN THE NAVY DEPARTMENT.

Naval Observatory: The National Observatory: Makes astronomical observations, corrects chronometers, etc. Appropriation, $51,660.

Total number of employees, 48.

Nautical Almanac: Prepares the American Ephemeris and Nautical Almanac, collects and disseminates information on navigation. Appropriation, $22,480.

Total number of employees, 20. Does not include detailed officers.

Hydrographic Office: Collects information and publishes charts with regard to direction and force of winds; set and strength of currents; feeding grounds of whales and seals; regions of storm, fogs and ice; the position of derelicts and floating obstructions; the best routes to be followed by steam and sail; also general hydrographic and marine meteorological information, weather warnings, etc. Appropriation, $103,940.

Total number of employees, 79, exclusive of those in twelve branch offices.

IN THE TREASURY DEPARTMENT.

The Coast and Geodetic Survey: General location of the National domain; latitudes and longitudes; surveys of coasts, rivers, lakes, inland waters, and deep seas adjacent to our coasts; magnetic and gravity research; general survey of the country; heights, geographical positions, etc., $401,370.

Total number of employees, 163.

The War Department also surveys military reservations, and runs boundary lines, such as the boundary line between the United States and Mexico, when called upon to do so.

IN THE INTERIOR DEPARTMENT.

The General Land Office: Is charged with the survey, sale and general management of the public lands and the issuing of titles therefor. It classifies mineral and swamp lands, protects the public domain from depredations, etc. Appropriation, $1,651,940.

Total number of employees: In Washington, 380; outside Washington, 789—1169.

The Geological Survey: By the original act this survey is charged with 'the classification of the public lands and the examination of the geological structure, mineral resources and products of the national domain.' This was first considered as limiting its work to the Territories, but in 1882 authority was granted to continue the work upon the geological map of the United States. Under this law the words 'national domain' are construed as including the entire country, and the provision for studying the 'products of the national domain' is understood to give the Geological Survey broad authority for many kinds of scientific work. At the present time the Survey is engaged on no work not specifically provided for by statute.

As at present organized, the Geological Survey has, beside two administrative branches, two scientific branches, viz, a geologic branch and a topographic branch.

The operations of the geologic branch include the preparation of a geologic atlas of the entire United States, and special geologic researches. The paleontologic work is subsidiary to the geologic work, and is conducted by a division under this branch. The other divisions of this branch are: A chemical laboratory, which analyzes minerals and ores; a lithologic laboratory, in which thin sections of rock are prepared for study; a division of mineral resources, which collects and compiles mineral statistics, and a division of hydrography, which studies the underground and surface water supplies of the country with special reference to applications thereof in irrigation.

The topographic branch has a division of triangulation and a division of topography, the latter divided into five sectlons.

Total appropriation for the Geological Survey, $774,862.38.

Total number of employees: 335 permanent, 265 temporary field men—600.

The Geological Survey, in addition to the above, is now engaged in making, under special enactment, a land sub-division survey in the Indian Territory.

Bureau of Education: Collects facts and statistics showing the condition and progress of education in the States and Territories and supplies information respecting the organization and management of schools, school systems and methods of teaching; promotes education. Appropriation, $57,520.

Total number of employees, 44.

The Decennial Census: Collects statistics covering population, mortality, manufacturing, railroad, fishing, mining and other industries; statistics of telegraph, express and insurance companies, and of churches; and other subjects according as Congress directs in the special law for each Census. These laws are usually drawn to include every reasonable suggestion that is made to the Committee on the Census, and vary more or less for each Census.

The result is that the Census is made to duplicate, to a large extent, the work of the permanent bureaus of the government. It is supplied with large sums of money, and reports are often made by it which ought, in the nature of things, to be made by other government bureaus. This leads to further duplication and great waste of time and money. Much work is expended upon ill-advised or poorly organized schemes.

The Permanent Census now proposed will consolidate much of this scattered work and prevent duplication almost entirely. It should take charge of several other statistical agencies and do, on a systematic plan through ten years, the work hitherto done in a haphazard way at intervals. It is a move in the same direction as that here advocated for the other scientific bureaus.

The average expense of the Census alone, not including the existing bureaus mentioned herein under their own Departments, is estimated at, $1,000,000 per annum.

THE DEPARTMENT OF AGRICULTURE.

This Department is wholly devoted to the development of the natural resources of the country. It is not restricted to agriculture, but aims to promote all of our industries, for which reason it might be better named 'The Department of Public Works.'

Its organization is as follows: The administrative and business officers are: Secretary's Office; Division of Accounts and Disbursements; Division of Publications with a Document Section; Gardens and Grounds; Seed Division.

Its scientific and technical agencies are:

Weather Bureau: Has charge of the forecasting of weather; the issuing of storm and other weather signals; the gauging of rivers; the reporting of temperature and rainfall conditions for the cotton, rice, sugar and other interests; the taking of meteorological observations to establish and record the climatic conditions of the United States, and the distribution of meteorological information. It includes: Five investigators, meteorological data division, forecast division, climate and crop service, instrument laboratory, monthly weather review and has one hundred and fifty-four weather observing stations, etc.

Bureau of Animal Industry: Inspects meat for interstate and export trade; is charged with the control and eradication of contagious diseases, and the inspection of imported and exported animals; investigates diseases of animals; prepares tuberculin and mallein for distribution to the States; studies animal parasites of domesticated animals, etc.; collects and distributes information in regard to the dairy industry, etc. It includes: Division of animal pathology, zoological laboratory, biochemic laboratory, inspection division, field investigations, dairy division, experiment station, and has, in addition, one hundred meat inspecting stations in the country; twenty-one quarantine stations on coast, Canadian and Mexican borders; nine stations for inspecting exported stock; nineteen Texas fever inspection places, etc.

Division of Statistics: Collects information as to the principal crop and farm animals; collects and coordinates statistics of agricultural production, distribution and consumption; publishes a monthly crop report for the information of producers and consumers and for their protection against combination. It supervises twenty outside statistical agents and has a section of foreign markets.

Biological Survey: Studies the geographic distribution of animals and plants; maps the natural life zones of the country; investigates the economic relations of birds and mammals, and promotes the preservation of beneficial and the destruction of injurious species.

Division of Botany: Maintains the National Herbarium (under the Smithsonian!), publishes information on the treatment of weeds, experiments with poisonous and medicinal plants, and tests seeds with a view to their increased purity and commercial value.

Division of Forestry: Experiments, investigates and reports upon the subject of forestry, and disseminates information upon forestry matters.

Division of Agrostology: Investigates the natural

history, geographical distribution and uses of grasses and forage plants, their adaptation to special soils and climates, and the introduction of promising native and foreign kinds.

Division of Vegetable Pathology and Physiology: Seeks, by investigations in the field and experiments in the laboratory, to determine the causes of disease and the best means of preventing them; studies plant physiology in its bearing on pathology.

Division of Entomology: Obtains and disseminates information regarding insects in their relation to vegetation; investigates insects sent to the division in order to give appropriate remedies; studies insect life in relation to agriculture in different parts of the country; conducts an insectary for studying the habits of insects, etc.

Division of Pomology: Collects and distributes information in regard to the fruit interests of the United States; investigates the habits and peculiar qualities of fruits; their adaptability to various soils and climates and conditions of culture, and introduces new and untried varieties.

Division of Chemistry: Investigates the methods proposed for the analyses of soils and fertilizers, and agricultural products; investigates and reports on adulteration of foods and on special subjects as ordered by Congress or the Secretary, conducts chemical investigations for other bureaus of the Department of Agriculture.

Division of Agricultural Soils: Investigates the texture and other physical properties of soils and their relations to crop production.

Office of Experiment Stations: Represents the Department in its relations to the experiment stations in all the States and Territories, for which the government appropriates $750,000 annually; collects and disseminates general information regarding the colleges and stations; publishes accounts of agricultural investigations at home and abroad; indicates lines of inquiry; aids in arranging for cooperative experiments; reports upon the expenditures and work of the stations.

Office of Fiber Investigations: Collects and disseminates information regarding the cultivation of textile plants, including new and hitherto unused kinds; investigates the merits of new machines and processes for preparing them for manufacture.

Office of Road Inquiry: Collects and distributes information concerning the systems of road management in the United States and the best methods of road-making.

The total appropriation for the Department of Agriculture is $2,448,532.

Total number of employees, 2,043.

Agricultural Experiment Stations: In addition to the above the government appropriates annually, for 54 Agricultural Experiment Stations in the States and Territories, $720,000.

Total number of employees in stations, 575.

The work of this Department is very closely related to that of the others. That of the Division of Soils, for example, depends upon the work of the Geological Survey. The work of the Weather Bureau is also very closely associated with that of the Hydrographic Office of the Navy and of the Coast Survey. These various Departments, Bureaus, and Divisions overlap and cross each other everywhere, causing many duplications and difficulties.

UNDER THE SMITHSONIAN INSTITUTION.

Bureau of Ethnology: Collects, compiles and publishes information with regard to the native races of America. Appropriation $45,000.

Total number of employees, 21.

U. S. National Museum: "The authorized place of deposit for all objects of art, archæology, ethnology, natural history, mineralogy, geology, etc., belonging to the United States or collected by any agency whatsoever for the government of the United States, when no longer needed for investigations in progress. The collections in the Museum are intended to exhibit the natural and industrial resources, primarily of the United States and secondarily of other parts of the world, for purposes of comparison."

Total appropriation, $187,725.

Total number of persons employed, 197.

COMMISSION OF FISH AND FISHERIES.

Formerly connected with the Smithsonian Institution. Not now connected with any department. Studies the rivers, lakes, bays and fishing grounds along the coast for the purpose of determining their food resources and of promoting the development of the commercial fisheries; collects and compiles statistics of fisheries; propagates and distributes fish and conducts laboratories for studying marine life, etc. Total appropriation $347,360.

Total number of employees, 172.

DEPARTMENT OF LABOR.

Not connected with any of the Executive Departments. Collects and publishes useful information on subjects connected with labor; its relations to capital; hours of labor; earnings of laboring men and women; means of promoting all their interests; investigates strikes and controversies between labor and capital; cost of production in competing countries, including wages, etc. Total appropriation $172,170.

Total number of employees, 94.

There are many other minor agencies scattered through the Departments which contribute much to the development of the country's resources.

The total appropriations for 1897 to the Departments and Bureaus above described as engaged in promoting science and the development of the country amount to $7,984,559.38.

The total number of employees in the above Departments and Bureaus is, not including the Census, 5,225.

GEOLOGICAL SOCIETY OF AMERICA: NINTH ANNUAL MEETING, WASHINGTON, DECEMBER 29–31, 1896.

THE Geological Society of America was called to order for its ninth annual meeting in the lecture room of the National Museum at 10 a. m., December 29th; President Joseph LeConte, of Berkeley, Cal., in the chair. An address of welcome was delivered by Mr. Charles D. Walcott, Director of the United States Geological Survey, to which a response was given by President LeConte. The local reception committee, through its chairman, Mr. S. F. Emmons, stated the arrangements that had been made for the entertainment of the Society, which included a daily lunch in the museum, a trip through the new Congressional Library with Capt. Green, the Superintendent, and the privileges of the Cosmos club to the fellows and their friends.

The Council presented its printed report, which was laid on the table for one day. Messrs. Hague and Kemp were appointed a committee to audit the accounts of the the Treasurer. The result of the election of officers for the ensuing year was then announced as follows: President, Edward Orton; First Vice-President, J. J. Stevenson; Second Vice-President, B. K. Emerson; Secretary, H. L. Fairchild; Treasurer, I. C. White; Editor, J. Stanley-Brown; Councilors, J. S. Diller, W. B. Scott.

The following fellows were also elected: Rufus Mather Bagg, Assistant in Geology at Johns Hopkins University and on the Maryland Geological Survey; Erwin Hinkley Barbour, Professor of Geology in the University of Nebraska; Samuel Walker Beyer, Assistant Professor of Geology, Iowa Agricultural College, Ames, Ia.; Arthur P. Coleman, Professor of Geology, Toronto University; Henry Stewart Gane, Assistant Geologist, U. S. Geological Survey; John Bonsall Porter, Professor of Mining, McGill University, Montreal; Arthur Coe Spencer, Assistant Geologist, U. S. Geological Survey.

A memorial of Robert Hay was then read by R. T. Hill, and one of Charles Wachsmuth, written by Samuel Calvin, was read by J. Stanley-Brown. A memorial of N. J. Giroux was postponed until the following meeting, as the manuscript was not at the moment available.

The reading of papers was then immediately taken up.

Crater Lake. J. S. DILLER, Washington, D. C.

Crater Lake is deeply set in the summit of the Cascade Range, of Southern Oregon. It is remarkable for its beauty and depth, the grandeur of its encircling cliffs and its geological history. During the glacial period the site of the lake was occupied by a huge volcano comparable in size with Shasta or Rainier. Since then the upper third has disappeared and a pit has formed in its base 4,000 feet deep. The pit is half filled with water forming Crater Lake. The paper was illustrated by lantern slides, and in the course of its presentation the crater lakes of Europe were briefly reviewed and compared with the one in Oregon. The lava flows were described and the peculiar radiating and glaciated valleys that pass out from the cone downwards, but that end in the air upwards. All the phenomena indicated a sinking in, absorption and withdrawal of the cone, leaving the present depression. In discussion President Le

Conte described his own visit to the lake in earlier years with Capt. Dutton, and H. F. Reid inquired as to the amount of erosion visible in the cliffs surrounding the water, to which Mr. Diller replied that there were no beaches to indicate it. On this line Prof. Shaler remarked the great increase in size that had been brought about in the Italian lakes by wave action and the need of caution in estimating the amount of rock that had been engulfed. He also cited the complex character of certain of the Italian ones. Mr. Diller replied that Crater Lake was a unit and gave reasons for thinking that it had not been much enlarged. Mr. Turner cited the vast tuff deposits of the Sierras, which he attributed to mud-flows of tuffs on a grand scale and suggested the applicability of the idea to some of the earlier phenomena in the history of Crater Lake.

The Leucite Hills, Wyoming. J. F. Kemp, New York, N. Y.

After a brief review of the occurrence of leucite the world over and especially in North America, the lantern was used to show the geographical situation and distribution of the Leucite Hills. Three of the outcrops, viz: the Leucite Hills proper, Orenda Butte and Black Rock Butte were described with photographs. Photomicrographs were next used to illustrate the rocks. It was shown that while leucite was as rich in some parts of the southern mesa as described by Zirkel, yet in other places and in the buttes to the north it became more rare and sanidine came in in much greater amount. Hauyne, large augite phenocrysts with rims of biotite and inclusions of limestone and sandstone, were also described. Zirkel's description was quoted in extenso and corroborated for the portions of the flows visited by the geologist of the Fortieth Parallel Survey, but the fuller field work has indicated considerable variability. The cones which look like craters were shown to be solid and were explained as portions which were viscous when intruded so that they remained over the old vents. Pilot Butte, north of Rock Springs, was also described, and the rock was shown to consist of augites and biotite in an isotropic base, regarded as glass. The determination of it as trachyte in Volume II. of the Fortieth Parallel Survey was therefore questioned.

Mr. Cross in discussion spoke of his own visit to the Hills twelve years before, and of the general parallelism of his observations with those of the speaker. Mr. Kemp expressed the hope that Mr. Cross would publish his observations and analyses at the earliest convenient date.

The Solution of Quartz under Atmospheric Conditions. C. Willard Hayes, Washington, D. C.

The projecting portions of quartz pebbles in conglomerates at a number of localities in the South have been found deeply etched, and chalcedonic quartz nodules partially dissolved. The chemical conditions under which the solution may have been effected were considered, and the bearing of the facts observed on the problems of erosion briefly pointed out. The latter point was more fully discussed in Mr. Campbell's paper on 'Erosion at Baselevel,' which followed. Mr. Hayes described the solution of the silica as occurring in a region of heavy forest where fires are frequent. In this way both organic acids and alkaline salts are afforded which effect the solution. Specimens were passed around in illustration which were very significant. Mr. Kemp, in discussion, called attention to the parallel conclusions reached by Dr. A. A. Julien in his study of the talus of the Palisades some years before. Mr. Gilbert cited the recent cementation of sands with silica in the arid regions of the West, and remarked the varying be-

havior of different forms of silica under solvents, some being easily attacked, others very resistant. Prof. Shaler raised the point that it was a reaction taking place on or near the surface and not in depth. Prof. Emerson described his observations on the schists and traps of the Connecticut Valley, where quartz and silicates on the surface were resistant, but where exposed in crevices to the drip of mosses and lichens they were deeply affected. Prof. Stevenson cited the sandstones of central Pennsylvania, where some were greatly corroded on the outcrops, whereas others, such as the White Medina, were very smooth. I. C. White corroborated the last speaker, and cited the change of flint to chalcedony in the lower Carboniferous limestones. M. R. Campbell described the smooth character of the Medina in Virginia at the surface, but its pitting under cliffs where exposed to dripping water. As the following paper was on the same general subject, practically the same discussion continued in connection with it.

Erosion at Baselevel. MARIUS R. CAMPBELL, Washington, D. C.

Many local baselevel plains in the Appalachian coal field show a sharp line of demarcation between the level floor of the basin and the surrounding slopes. Since the streams are too sluggish to mechanically transport the waste of the land, this condition can be explained only by supposing that most, if not all, of the material which is swept in from the surrounding slopes is removed by solution when it reaches the floor of the basin.

Etched quartz pebbles and geodes are evidence that under favorable conditions silica may be dissolved; therefore it remains to determine whether such conditions are liable to be present on a baselevel plain. The solution of the quartz appears to take place only in the presence of decaying vegetation, consequently the swampy character of such a plain would offer almost ideal conditions for the removal of the silica as fast as it is washed in from the surrounding slopes. The alumina is still unaccounted for, but the question was raised that some similar reaction may take place, which removes this compound also.

Mr. Turner, in discussion, emphasized the preeminent insolubility of the quartz that forms the veins of the Sierras, as shown by its occurrence in the prevailing boulders of the local conglomerates. He stated that the pitting of chalcedony may be due to the solution and removal of limestone. Mr. Keith also supported the insolubility of the quartz and cited the baselevel superficial soils and gravels near Washington. The residual pebbles are derived from the quartz veins, whereas the other minerals of the gneisses are only represented by a red clay. Mr. Hayes, in support of Mr. Campbell's position, mentioned the ponds in the plateau of the Coal Measures of the South, which plateau is deeply dissected by streams. He stated that much silica might be removed and yet no pitting result to indicate it. Dr. Wadsworth mentioned his own observations on the Potsdam and St. Peter's sandstones of Wisconsin, made many years ago. An outer shell of hardened rock forms by redeposition of silica, and may even be appreciable within a year's time. He also mentioned the well recognized removal of silica in the formation of the soft hematites of Lake Superior, and emphasized its ready and great solubility under favorable conditions. Professor LeConte laid stress on the solubility of different forms of silica, and Mr. Hayes, in closing the discussion, admitted freely the frequent insolubility of quartz, but still urged the significance of the observations of Mr. Campbell and himself, which, indeed, were unassailable.

The Origin of Certain Topographic Forms. MARIUS R. CAMPBELL, Washington, D. C.

This paper consisted of a study of the various conditions affecting erosion for the purpose of determining the origin of certain exceptional surface features which have not hitherto been satisfactorily explained. The writer reaches the conclusion that local radial movements of the crust of the earth are largely responsible for the exceptional physiographic features.

This theory was then applied to the North Carolina section of the Blue Ridge, and it was shown that the striking features of that region can be explained by supposing a monoclinal uplift to have occurred along the eastern front of the Ridge while the main body of the Piedmont plain remained at sea level. On this assumption the various remnants of peneplains in the Blue Ridge region correspond to halts in the general uplift, and they collectively represent the same, or a portion of the same time interval which is marked by the Piedmont plain to the eastward of the uplift.

Since local uplifts are liable to occur at any time and in any place, the resulting forms may be found in other localities than the Appalachians, and physiographers should learn to distinguish them, for they constitute a record of exceptional conditions.

The paper was illustrated by a large map which brought out the position of the Appalachians south of Roanoke, Va., to which the hypothesis especially applied, but the region of the Black Hills was also cited as a promising place in which to test it.

Mr. Keith, in discussion, spoke in opposition to Mr. Campbell's view and sketched a district on the Nahantahala and Hiwassee rivers in support of his contention. It was later shown that the district, however, was not in the region described by Mr. Campbell and had but limited bearings on his thesis.

Homology of Joints and Artificial Fractures. J. B. Woodworth, Cambridge, Mass.

A synopsis of the structure of the typical joint was given from a previous paper (Proc. Boston Soc. Nat. Hist., Vol. XXXIV, 1896, pp. 163–183). A series of specimens showing the relations between joints and artificially fractured surfaces was exhibited. Obliquity of the biplanes in the margin of fractures is found of value in determining the axis of breaking tension arising from tension, contraction or shearing force. Incidentally, a map symbol for joints was proposed.

The paper was illustrated by an excellent and striking series of lantern slides which made the matter clear.

Physiographic Development of the District of Columbia Region. N. H. Darton, Washington, D. C.

An outline of the physiographic conditions which have characterized each of the earlier stages in the Coastal Plain history of the region and a description of the development of the present topography was presented in a very interesting manner. By means of lantern slides from maps and photographs, the ups and downs of the old shore-lines were shown and the formation of the terraces. In this way the development of the Potomac, Magothy, Severn, Chesapeake, Lafayette and lower and upper Columbia formations were traced.

Dikes in Appalachian Virginia. N. H. Darton, Washington, D. C.

An announcement of further discoveries of diabase dikes and of interesting dikes of acidic eruptives among the Paleozoic rocks of central Appalachian Virginia. When the specimens were passed around, the acidic intrusions, containing, as they did, quartz, feldspar, mica and hornblende phenocrysts in a white ground mass, excited extreme interest, and, as remarked by J. E. Wolff, were very similar to the quartz-mica-porphyrite in the Cortlandt series, near Montrose, N. Y.

On the Changes of Drainage in the Ohio River Basin. FRANK LEVERETT, Denmark, Iowa.

A brief outline of the results of earlier observations on the Ohio and tributaries was followed by a presentation of the results of the writer's studies the past season. The principal topics discussed were as follows: 1. The extent and probable date of deposition of marine deposits found on the lower Ohio in Indiana, Kentucky and Illinois. 2. Comparison of the probable early drainage systems with the present system. 3. Factors leading to changes of drainage. 4. An interpretation of the relative influence of the several factors in producing the changes of drainage which have occurred in the Ohio River basin. In developing this general plan the writer described, by means of a map, the present drainage systems of western Pennsylvania and their probable discharge, through northerly outlets, now indicated by present streams, into Lake Erie. The former limit of the northerly drainage was probably along the Panhandle of West Virginia. The old drainage lines were detected by following up the remnants of the fluvial plains. Of the three possible causes of change in drainage systems, viz, uplift, stream piracy and glaciation, the last named was regarded as most probable. Prof. G. F. Wright opened the discussion by objecting to some of the proposed northerly outlets as of insufficient size to carry the volume of water. H. P. Cushing later on supported this objection strongly in the case of the Cuyahoga river. Mr. Leverett replied that the gorge was as large as that of the present Ohio below Louisville. M. R. Campbell endeavored, by means of the changes suggested by Mr. Leverett, to account for the puzzling phenomenon of Teazes Valley and its boulders from the New River Basin; but I. C. White, who originally discovered and described Teazes Valley, stated that it could be satisfactorily explained by the Mud and Guyandotte rivers, which now partially traverse it. Prof. Orton remarked the depth of the drift in northwestern Ohio, and the debt that geology owed to the drillers who had shown many buried channels in prospecting for oil. The depth is over 500 feet in some channels. The peculiar relations of the Mercer reservoir and the difficulty of explaining it were also touched on. Prof. Shaler emphasized the stability and lack of change in the drainage lines of Kentucky and his disbelief that ice had ever crossed the Ohio river, on the ground that water would satisfactorily explain the observed phenomena in Kentucky.

The Society then adjourned until the following day at 10 a. m. The fellows were very generally entertained by the resident geologists of Washington during the early evening, and at 8:30 reassembled in the large hall of the Columbian University to listen to the Presidential address of the retiring President, Prof. Le Conte, upon the title, 'The Different Kinds of Earth Crust Movements and Their Causes.'

DECEMBER 30, 1896.

The Council met at 9 a. m., and the Society at 10. The report of the Council as previously printed and distributed was adopted. A memorial of N. J. Giroux, written by Mr. R. W. Ells, was read by Prof. F. D. Adams. The photograph committee then reported through its chairman, Mr. G. P. Merrill. 179 views were received during the year, bringing the total up to 1429. The auditing committee reported favorably regarding the Treasurer's accounts. The Secretary announced that the Council recommended a change in the constitution so as to add the Editor to the Council, and some other verbal changes, all of which will be acted on one year hence. The reading of papers was then resumed.

Notes on the Structure of the Cranberry District in North Carolina. Arthur Keith, Washington, D. C.

The paper opened with a sketch of the topography, drainage and geology of the district. The latter involves seven members below the Siluro-Cambrian limestones. They are in general schists and gneisses and Pre-Cambrian volcanics. A sketch map was used to illustrate the faults of the region. Great folds also intervene. Faults occasionally show breccias and slickensides, but these are not marked. Pressure has caused metamorphism and schistosity. Remarkable cases of sheared conglomerates of quartz porphyry and granite pebbles were exhibited. The phenomena gave accurate data for determining the depths of zones of crushing and flowage. A great shear zone in an east and west line, with a passage of the southern part beyond the northern, was described. The curious behavior of sediments regarding the hard crystallines, and their strange relations to them, if we assume a simple case of compressive stress, transmitted by the sediments, leads the author to believe in the upthrust of the crystallines through and over the sediments.

Note on the Stratigraphy of Certain Homogenous Rocks. C. H. Hitchcock, Hanover, N. H.

The object of the note was to call attention to recent discoveries of obscure planes of stratification cutting the cleavage at large angles, as noted in two formations in the upper Connecticut Valley. These discoveries will make it necessary to question the reliability of many of the observations hitherto made as to the positions of the strata.

The speaker described an argillite and a quartzite at Thetford, near Hanover, whose true bedding he had been unable to discover until lately. Finally the true stratification was identified in many lines nearly at right angles with the cleavage and as indicated by little quartz veins. Quartzite in another locality was also shown to have suffered so much change that its stratification was obliterated. Various examples were further cited to bring out the relations of cleavage and stratification. In discussion, Mr. Lane asked if the observations of Prof. Hitchcock and Mr. Keith carried out Van Hise's rule that cleavages cutting stratification at right angles indicated the presence of synclines and anticlines. Messrs. Hitchcock and Keith replied that so far as their observations went they did.

Unconformities in Martha's Vineyard and Block Island. J. B. Woodworth, Cambridge, Mass.

Beginning below, plant-bearing beds of Cretaceous age appear in both islands without their base being exposed. On Martha's Vineyard marine Cretaceous strata overlie the plant beds; but contact has not been worked out. Above the Cretaceous and on an eroded surface rests the Miocene of Lyell and Dall, composed of (*a*) the osseous conglomerate, (*b*) the green sand, (*c*) the yellowish green sand. There was erosion in the area between (*a*) and (*b*), probably also between (*b*) and (*c*). Fragments of a Pliocene formation have been detected at Gay Head, but little is known regarding it. A marked unconformity now appears on Gay Head and Block Island at the base of the lowest Pleistocene boulder formation. The Miocene has been locally swept away at Gay Head. On Block Island this early Pleistocene rests upon the surface of the Cretaceous white clays, the Miocene being entirely unknown. There was probably some folding of strata at Gay Head before the deposition of this boulder bed. After the deposition of from 25 to 50 feet of compound gravels and sands, more folding took place over Martha's Vineyard and Block Island. The Mohegan Bluff beds on Block Island and the Tisbury beds on Martha's

Vineyard, of glacial origin, were now laid down on eroded surface of folded older strata. In the Vineyard subepoch of erosion the islands were deeply denuded; then followed the last glacial epoch with deposition of moraines and sand plains.

W. B. Clark, in discussion, called attention to the parallelism of the Cretaceous and Miocene on these islands and in New Jersey and Maryland. David White on paleobotanic evidence of age stated that the plant-bearing clays belonged with the Amboy clays. He also commented on the interest attaching to the subdivision of the Tertiary beds. G. K. Gilbert remarked the complexity of the later Pliocene and glacial deposits, involving, as they do, very coarse and fine components, and coinciding with Chamberlin's observations in the West. David White inquired about the correlation of the beds of the Elizabeth Islands with those of the Vineyard. Mr. Woodworth replied that it could at present be but roughly carried out.

The Cementing Materials of the Tertiary Sands and Gravels of Western Kansas. ERASMUS HAWORTH.

In the absence of the author an abstract was given by G. K. Gilbert, who stated that the cementing material proved to be aragonite with subordinate calcite, and sketched the relation of the deposition of the cement to the conditions of aridity in earlier times.

The Work of the United States Geological Survey in the Sierra Nevada. H. W. TURNER.

The speaker had a series of geological atlas sheets of the work in the Sierras and, using these as illustrations, outlined the large features of the geology.

President LeConte remarked the complexity of the geology of the Sierras. In reply to a question of J. E. Wolff regarding the age of the granodiorites, Mr. Turner replied that they were late Jurassic or early Tertiary and that they exhibited remarkable examples of contact metamorphism on the Jurassic slate. Mr. Walcott remarked the completion of the work on the Gold Belt and the plans for the future work of the Survey in the Sierras.

The Cornell Glacier, Greenland. RALPH S. TARR, Ithaca, N. Y.

The speaker outlined the old view of the continuous ice sheet from Greenland to North America, and the later views of Chamberlin and Salisbury regarding the limited and strictly insular character of it. He described the angular topography of the highlands in the interior, and the more rounded, glaciated slopes terminating in cliffs near the coast, interpreting even the jagged mountains as compatible with glaciation. The location of last summer's work was shown and the Cornell glacier was described. The local rocks are gneiss and schists with diabase dikes. The hills are rounded toward the ice, but are angular toward sea. The ice has covered in recent times Wilcox Peninsula and Duck Islands, showing an extension 30 or 40 miles beyond its present position and from 3,000 to over 7,000 feet thick. The ice is now retreating. Reference points were established from which to measure future movements. All the nunataks have been glaciated, though now bare.

G. F. Wright remarked the parallelism between these observations and his own on the edge of the Arctic circle.

Prof. Heilprin also corroborated the conclusions given about the former larger extent of the ice from his own observations in the region and especially on the Island of Disco. The coast was outlined and the character described from Disco to Robertson Bay. The observations of all these speakers, as well as the important paper of Mr. Barton which followed, flatly controverted the views which have recently been expressed regarding the former extent of the ice and certain of its local phenomena.

Shore-lines of Lake Warren, and of a Lower Water-level, in Western Central New York. H. L. Fairchild, Rochester, N. Y.

The beach of the glacial Lake Warren has been traced with practical continuity from Crittenden, N. Y., where long known, eastward to beyond the meridian of Rochester, with an altitude of about 880 feet. A lower beach, with an altitude of 700 feet and of good development, has been detected for a considerable distance, and other evidences of static water at this level extend over a wide area.

The paper was illustrated by a colored map of New York State showing the outlines of Lakes Warren and Iroquois. The speaker sketched the recent views of Lake Warren's restricted area, and of its outlet into the lake formerly in the basin of Lake Michigan, called Lake Chicago. The tracing of another strong beach above Geneva was also shown, and presumably a continuation of the beach at Chittenden followed. The reading of the next paper took place before discussion.

Old Tracks of Erian Drainage in Western New York. G. K. Gilbert, Washington, D. C.

The last stage of Lake Warren was ended by the shifting of the outlet from Michigan to New York. Between that date and the establishment of the Niagara River the discharge from the Erie basin crossed western New York on lines determined by the relations of the shifting ice margin to the topography.

Attention was called to Lake Warren, which stood 500 feet above Lake Iroquois, and to the areal distribution of both. The spillways were described that were scoured out, when, on the removal of the ice barrier that held back Lake Warren, the water fell to the level of Warren. These old lines of drainage were described with their boulder pavements, cataracts and one-sided channels, formed when the ice presented the other side. The speaker showed these at various points, of which those between Rochester and Niagara Falls are of especial interest. Inference about the east and west alignment of the ice front were also drawn.

G. F. Wright inquired about the relations of the lakes with the Horseheads outlet and later remarked the fresh topography of the spillways. R. S. Tarr also asked about the correlation of the beaches with the Cayuga Lake terraces. Mr. Gilbert replied that Horseheads was at that time higher than the water plane and that he had attempted no correlation with the terraces of Cayuga Lake

The Assumed Glaciation of the Atlas Mountains, Africa. Angelo Heilprin, Philadelphia, Pa.

Vast boulder and pebble deposits cover a large part of the region of North Africa, both at sea-level and on the inland plateaus (and mountain slopes) to 3,000 feet elevation and more. These have in places much the appearance of morainic and true drift material, and as such have been described by some geologists and geographers. But their relations are with oceanic and torrential modelling of the land surface and they give no basis for the supposition that ice action was involved in their making. Neither on the highest points of the Atlas Mountains in Algeria nor on their slopes were any evidences of glaciation met with.

The observations were gathered during a trip across the Atlas Mountains the past summer, through Tunis and Morocco into the Sahara. A resumé was given of previous observations on the supposed glaciation of some of these summits. With a sketch map of northern Africa the speaker remarked the general character of the mountains and their Alpine character. He then described the supposed glacial moraines at

various points and interpreted them as formed by water. No striation, polishing or glacial topography were seen. All seemed due to great accumulations in a westward arm of the Mediterranean that set in from Tunis and ran far up into the mountainous country to the westward.

The Relation of an Abandoned River Channel in Eastern Iowa to the Western Edge of the Illinois Icelobe. FRANK LEVERETT, Denmark, Iowa.

The extension of the Illinois icelobe into southeastern Iowa, discussed by the writer at the Philadelphia meeting, is found to have so blocked the drainage along the Mississippi that the line of discharge was temporarily thrown across the plains of eastern Iowa. The several rivers of eastern Iowa that now lead southeastward into the Mississippi entered this temporary line of drainage and followed it southward. A description of the channel formed by this temporary river was given, and the history of the discovery of its several sections was outlined. Inferences were drawn from it concerning the drainage conditions at the time of the culmination of the Illinois icelobe. The paper was illustrated by a sketch map of Iowa.

F. B. Taylor asked about the channel used by the river during its short cut into its present channel between Cedar river and Iowa river. Mr. Leverett replied that it followed the present channel of the Iowa river. Other remarks regarding the ancient gradients of the river were made by Prof. Reid.

Glacial Observations in the Umanak District, Greenland. GEORGE H. BARTON, Boston, Mass.

The result of studies upon the margin of the inland ice for a distance of about fifteen miles from the nearest land was given. And the character of the surface, of the marginal edges of very steep or vertical slope, of the dust holes area, of the billowy area, and of the smooth, level expanse beyond were described. Ice-walled lakes, with small tributary streams, and large streams were met. Studies upon the Great Karajak glacier, its rate of motion, character of surface and margin, movement phenomena as seen along edge, entrance into waters of fiord, its source in the ice cap with crevasses for miles inland, proved of the greatest interest. Smaller glacial tongues along the Karajak fiord, coming from the local ice cap of the Nugsuak peninsula, were described, together with studies upon the glaciers entering Itivdliarsuk fiord and observations on the former greater extension of the ice cap and the distribution of drift and the transportation of material by icebergs. The paper was graphically illustrated by a beautiful and significant series of lantern slides. C. H. Hitchcock asked about marine deposits, such as Champlain clays. Mr. Barton replied that none were met. As Mr. Barton had stated that the survey of the party had indicated a slight movement of the ice up stream near the shore, and down stream at the outer stakes in the glacier, in each case of but a fraction of a foot, Prof. Reid inquired about the accuracy of the instruments, and cited the need of readings closer than a minute. Mr. Barton replied that they had been made with a high-grade surveying transit, but as that part of the work was directed by a colleague he could not give further particulars. A. Heilprin stated the occurrence of marine deposits with shells in northwest Greenland. Mr. Barton's paper was one of the most interesting and important of the meeting and coincided with the observations of Prof. Tarr further north as earlier cited. The British Admiralty charts, for not using which Prof. Wright has been criticised, were found quite unreliable by Mr. Barton and were rejected in favor of Danish maps.

The Nipissing-Mattawa River, the Outlet of the Nipissing Great Lakes. F. B. Taylor, Fort Wayne, Ind.

When the waters of Lakes Superior, Michigan and Huron were making the Nipissing beach, their outlet was eastward over the Nipissing pass at North Bay, Ontario, to the Ottawa valley. This outlet river is called the Nipissing-Mattawa River and the three upper great lakes of that time are called the Nipissing Great Lakes. During the autumn just passed the course of the outlet river was explored. The Nipissing beach is well developed at North Bay at an altitude of about 700 feet above sea-level. On the swampy col between Lake Nipissing and Trout Lake it was a little over a mile wide with a maximum depth of about thirty feet and an average of from ten to fifteen feet. The beach is faintly but clearly marked to the foot of Trout Lake and the shore mark of the river in expanded portions and at some of its rapids was found at several points below. The best evidence of the existence of the ancient river was found where it crosses the course of a bouldery morainic deposit. The boulders in such rapids were scoured by the sand and pebbles moved along by the current into peculiar forms readily recognized. These rapids were located at moraine crossings. Others were less certainly determined. The place of one cataract was also found. In one of its rapids the ancient river was between 600 and 700 feet wide, with an average depth of 35 to 40 feet. This corresponds very closely, in a general way, with the size of the modern St. Clair and Detroit rivers. The remains of the ancient river agree with the Nipissing beach in indicating that this arrangement of the upper Great Lakes endured for a relatively long period of time.

The paper was preceded by a review of the works of previous observers. In discussion G. F. Wright remarked the interest all must feel in the establishment of this thesis and G. K. Gilbert discussed its relations to Niagara Falls as a chronometer. Increasing knowledge brings increasing complexity.

Moraines of Recession and their Significance in Glacial Theory. F. B. Taylor, Fort Wayne, Ind.

A summary of facts presented last summer at Buffalo was first given regarding moraines between Cincinnati and the Straits of Mackinaw, there being 15 in all, whose differences depend on the topography of the land. The oscillations of the ice front and the moraines is so regular in period that ups and downs of the earth's surface cannot be utilized in explaining them. We are forced to refer to astronomical causes and their effects on climate. Precession of the equinoxes, modified by the revolution of the apsides, was cited as the best cause, with intervals of 21,000 years. This time seems long, but it is corroborated by the large amount of clay in the moraines. The effects of the precessions of the equinoxes were analyzed. The oscillation was corroborated by the relations of the boulder belts in three moraines near Fort Wayne, Ind., to the line of drainage apparently taken by the river that drained the glacier.

In discussion G. K. Gilbert emphasized the interest of the ideas and spoke of them as supplying, if true, the clue for the correlation of the moraines in various regions. Frank Leverett spoke of the importance of the estimates of time and significance of the boulder belts. G. F. Wright remarked that moraines of recession with halts, still implied forward movement of the rear ice continually during halts. Mr. Taylor, in reply to the last speaker, described the moraines as having steep outer slopes and gradual slopes inward, which is only explicable by an advance of ice up to a point and then its accelerated retreat. Mr. Heilprin raised

the point that moraines in existing glaciers are steepest toward the ice and that they were the best illustration of what took place in the ice period. Inferences, therefore, regarding the relations of the old moraines to the ice should always be drawn with this in mind.

Variations of Glaciers. HARRY FIELDING REID, Baltimore, Md.

The paper gave a summary of the first annual report of the International Committee on Glaciers. Information received relating to the variations of American glaciers during the past year, as well as of those in other parts of the world, indicated a general recession, although there were some minor exceptions. Illustrations were given and an earnest appeal was made that all geologists and travelers visiting glaciers establish permanent bench marks and directions from which photographs can be taken, as other visitors may reach such regions. Very complete records can thus be made.

The reading of this paper closed the work of the day. At 7:30 p. m. the Society reassembled for the annual dinner at the Hotel Raleigh. All felt great satisfaction to see Prof. Emerson in his familiar place as toastmaster, and the presence of about fifteen ladies, mostly wives of the Fellows of the Society, started an innovation that it is to be hoped will be continued, for it improves greatly the social side of meetings. The banquet was most enjoyable from all points of view, especially in that the Society had an opportunity to extend its congratulations to the retiring President upon the approaching celebration of his golden wedding anniversary.

On Thursday morning at nine o'clock nearly all the visiting Fellows assembled at the office of Captain Green, at the new Congressional Library, and were most courteously conducted over the building. All viewed its magnificant halls and frescoes almost with astonishment, and certainly with great satisfaction that a building so long needed had at last been worthily constructed.

At 10 a. m. the regular sessions were resumed with a slim attendance, which, however, rapidly grew as the members who had been at the Library returned. It was voted that two sections be organized after the reading of the first two papers, inasmuch as it would be otherwise impossible to finish the programme. A letter was also read from Lieut. Peary outlining a plan for another expedition to Greenland next summer, in which it was hoped that various institutions would combine and locate stations for the observation and study of the ice sheet at various points along the coast and in cooperation. The Society gave its approval of the plan in a general way. The reading of papers was then resumed as follows:

Mechanics of Glaciers—Moraines and Stratification. HARRY FIELDING REID, Baltimore, Md.

Observations were made on the Forno Glacier last summer to test the ideas presented to the Society at the Philadelphia meeting. Measures of the movement were begun but not finished. What is usually called the 'ribboned structure' is probably the outcrop of the strata, as Agassiz contended.

Moraines require a new classification into: 1st, those which have their origin below the névé line; and 2d, those which have there their origin above it. The latter present characteristics which have not hitherto been carefully described. It was shown that the débris above the névé line proceeds diagonally downward into the body of the glacier itself as it becomes buried by the successive annual snowfalls that cause the general stratification. The paper was beautifully illustrated by lantern slides. Presi-

dent LeConte inquired about the relations of the phenomena of the dirt bands described by Agassiz years ago. Mr. Reid stated that he was uncertain exactly what was meant by them, but he believed them to be the same as the lines of stratification and to originate as he had described, by the annual burial of fine débris above the névé line.

The Pre-Cambrian Topography of the Eastern Adirondacks. J. F. Kemp, New York, N. Y.

The discovery of outliers of Paleozoic strata, oftentimes of very small area, far within the Archean (perhaps in part Algonkian) complex of the Adirondacks, has made possible the tracing out of some of the Pre-Cambrian topographical features. The recent completion of the topographical sheets of the U. S. Geological Survey has enabled us to illustrate the matter quite fully and with comparisons of present altitudes. It was shown that the early Paleozoic sea apparently set up into narrow embayments in what were doubtless old submerged valleys, which being now indicated by the outliers, reproduce, in a general way, some features of the old topography. The abundance of Potsdam boulders in the drift far in the hills leads to the conclusion that the Potsdam was probably more abundant in the interior before the ice invasion than now.

After a brief introduction which cited the older Cambrian deposits of Vermont and the presumptive evidence that the Adirondack crystallines were a land area, carved by erosion during Cambrian time, slides of topographic maps colored hypsometrically as well as geologically were thrown on the screen and the facts on which the conclusions were based were thus illustrated, due allowance being made for faulting. Crystalline limestones have largely determined the valleys.

In discussion M. R. Campbell inquired if any variety in the basal Potsdam had been noted in different regions, to which the speaker replied that on the east and southeast almost none were apparent. R. S. Tarr remarked the parallel conditions in New Jersey, where, however, folding has supervened. H. P. Cushing described similar phenomena on the north side of the Adirondacks, and especially outliers of crystallines entirely surrounded by Potsdam, and the projection of the latter into the mountains where limestone occurred. F. D. Adams instanced the same relations in Canada around the old Laurentian protaxis, and in particular referred to the observations of Mr. Low in Labrador, showing very strikingly the gradual encroachment of Cambrian and Ordovician sediments into embayments in the old crystallines. A. C. Lane remarked the parallel phenomena in Michigan. H. F. Reid inquired about the amount to which the strata were tilted, to which the speaker replied that the Paleozoics were all notably flat and seldom reached 15 degrees.

The Society then divided into two sections. The one in which the petrographic papers and those dealing with the crystalline rocks were presented assembled in the rooms of Dr. G. P. Merrill of the Museum, the others remaining in the original hall. In the latter the first paper presented was the following, the report for which and the following is based on notes kindly taken by Prof. H. S. Williams and from the abstracts furnished by several authors.

On the Southern Devonian Formations. Henry S. Williams, New Haven, Conn.

The remarkable contrast between the northern and southern Devonian formations was shown. The former consists of a considerable number of separate formations, of differing kinds of sediments, and holding separate and distinct faunas and together

making a series of rocks several thousand feet in thickness, while the southern representations of the Paleozoic series in Tennessee and Alabama is a single formation composed of a single kind of sediment, the Black Shale, and holding, when pure, only one fauna of very few species. It occupies the whole interval between the Silurian and Carboniferous strata. In order to account for the differences the principles of (a) difference of origin for rock: (viz. (1) organic and (2) fragmental), and (b) the sorting power of moving waters were found applicable to most of the cases, but not to account for the origin of the black shales or of the Oriskany.

For the explanation of the Black Shale an origin of the sediments was found in the decay of Lower Silurian limestones composing the surface of the Cincinnati plateau, which occupied the center of the great interior continental basin. The distribution of these black shale muds was accounted for by oceanic currents. Their absence from central Tennessee and neighboring tracts was referred to the scouring of the shallows and to lack of sedimentation; the absence of other faunas to the fatal effects of the fine mud upon marine life. The time of beginning of the sediments was placed at the close of the crisis which brought in the Oriskany sediment; the black color was explained by Sargasso-sea vegetation. The Oriskany formation and its distribution from a center in eastern New York, along the northern shores of the intercontinental basin and along the eastern shores, decreasing in force with extension southward, and its absence west of the Cincinnati plateau, were explained as the result of sinking of the northeast rim of the basin in the Lake Champlain region sufficient to open communication through the St. Lawrence valley, past Montreal, with the eastern sea, and allowing of extensive wash by tidal flows through the estuary or channel, thus bringing into the basin great quantities of coarse sand and the new Oriskany fauna.

In the discussion that followed Mr. Hayes called attention to the thickening of the black shale at its extreme extension southward in Alabama, thus confirming the probability that there was land elevation in that direction during Devonian time.

A Complete Oil Well Record in the McDonald Field between the Pittsburg Coal and the Fifth Oil Sand. I. C. WHITE.

The speaker stated that a new well had been sunk at Pittsburg from the Pittsburg coal seam, 5,800 feet to or below the Carboniferous. Samples had been preserved every five feet, and the well is to go 500–600 feet deeper, making it the deepest well in America and second only to one in Germany.

Structure of the Newark Formation of Western New Jersey. HENRY B. KÜMMEL, Chicago, Ill.

The sedimentary rocks of the Newark formation in western New Jersey are divisible into three subdivisions to which the geographical names Stockton, Lockatong and Brunswick have been given provisionally. The Stockton beds are the lowest and consist of arkose conglomerates and sandstones, freestones and red shales, interbedded and many times repeated. The arkose beds are characteristic of this subdivision. The Lockatong beds are next and consist of hard, black and dark green argillites and shales with some red flagstones. The black argillites are characteristic of this division. The Brunswick beds consist in the main of soft red shales with a few sandy layers. Along the northwest boundary all three divisions lose their type character and grade along the strike into coarse sandstones or massive conglomerates. Two profound faults traverse the formation and repeat the series twice. Faults of a few feet are not uncommon. Although the

monoclinal structure prevails, low folds, particularly in the Brunswick beds, are common. A total thickness of 20,000 feet for the Newark system across New Jersey was given as the nearest estimate of the writer.

The Upper Cretaceous Formations of the Northern Atlantic Coastal Plain. William B. Clark, Baltimore, Md.

This paper was prepared in cooperation with Messrs. R. M. Bagg and George B. Shattuck, who had been Prof. Clark's geological assistants for several years. The areal distribution of the five Post-Potomac Cretaceous formations was represented upon a map on the scale of one mile to the inch, which embraced the area between New York Bay and the Potomac River. The variations in sedimentation and structural relations presented throughout this distance of over two hundred miles were described, as well as the faunal characteristics of the several formations.

The Matawan-Monmouth formations were shown to be equivalent of the Cretaceous Eutaw—Rotten Limestone—Ripley groups of Alabama; and the Pamunkey equivalent of the Eocene Lignitic—Claiborne group of the same area, so that the Rancocas-Manasquan-Shark River formations represent the interval between the Ripley and Lignitic, the first two being of Cretaceous age, the last of Eocene age.

It was also shown that the Upper Cretaceous formations of the Atlantic coast are the approximate equivalents of the Senonian and Danian, of Europe.

Notes on the Stratigraphy and Paleontology of the Laramie and Related Formations in Wyoming. T. W. Stanton and F. H. Knowlton, Washington, D. C.

I. The Ceratops Beds of Converse County. II. The coal-bearing series of the Laramie Plains. III. Localities in Bitter Creek Valley—Block Buttes, Point of Rocks, Rock Springs. IV. Evanston and Hodges Pass. V. Other localities considered—Carbon, Wyo.; Crow Creek, Colo.; Coalville, Utah. VI. Résumé.

(The undersigned (J. F. K.) learned with regret, when it was too late to remedy the matter, that no further abstract of the above paper had been obtained. He had thought it was read by title.)

Geology of Northeastern Washington. I. C. Russell.

The speaker described the remarkable cañon of the Snake River and said it equalled in grandeur the Grand Cañon of the Colorado. There are walls 4,000 feet high and a valley 15 miles across. 4,500–5,000 feet of lavas have been cut through. In the lavas secondary columnar fracturing can be detected radiating from the centers of primary columns and at right angles to the faces of the latter.

A Study of the Nature, Structure and Phylogeny of Dæmonelix. E. H. Barbour, Lincoln, Neb.

The new fossil Dæmonelix is a fresh-water fibrous alga aggregated together into various forms, the chief of which are large regular upright spirals, sometimes with, sometimes without an axis. These fossils occur in every exposure in the Loup Fork Tertiary on Pine Ridge, Sioux County, Neb. They stand invariably upright in fairly coherent sand rock. Area about 500 square miles. Vertical range about 200 feet. Structurally Dæmonelix is cellular but not vascular. It consists of simple parenchymatous tissue without trace of fibro-vascular bundles.

In its phylogenetic relations we can trace apparent development from the simple Dæmonelix 'fibre' in the lowest beds, successively through the Dæmonlix 'cakes,' Dæmonelix 'balls,' Dæmonelix 'cigars' or 'fingers,' and the Dæmonelix 'irregular' to

the Dæmonelix 'regular' of the topmost beds. Though the development is too sudden and startling, nevertheless this is in the order of occurrence.

The paper was illustrated by a superb and demonstrative series of lantern slides and was listened to with the greatest interest. The writer incidentally reviewed the various, more or less absurd, explanations of the 'Devil's corkscrews,' that had been advanced, but in the end he established his own views to the entire satisfaction of those present.

The Society at the conclusion of the paper and after being joined by the other section adjourned until the summer meeting.

The separate section having in hand the papers relating to petrography and crystalline rocks organized with Prof. Emerson as Chairman and Mr. Turner as Secretary. The first paper was the following:

Notes on the Pre-Cambrian Volcanics of the South Mountain District. FLORENCE BASCOM, Bryn Mawr, Pa.

By means of a map of the district and a new and beautifully preserved series of specimens, the textures of the old volcanic rocks, such as spherulites, flow-lines, lithophysæ, etc., were illustrated. In certain sections micropoikilitic textures were found which are secondary as contrasted with the views of Clements and Harker, who, in other localities, regard them as primary. Specimens of lithophysæ were exhibited, charged with piedmontite.

Mr. Lane corroborated the interpretation of the micropoikilitic texture as secondary in many cases on Lake Superior and the micropegmatitic as original. He emphasized the need of care in distinguishing them. Mr. Iddings remarked that some micropoikilitic textures were original and some secondary beyond question, and Mr. Cross, from his study of spherulites, corroborated the same view.

Notes on Rock Weathering. GEORGE P. MERRILL, Washington, D. C.

The paper began with a discussion of the changes, both chemical and physical, which have taken place during the decomposition incidental to the reduction of a gray, micaceous gneiss to the condition of a red, clayey soil. The facts brought out by analysis lead to a discussion of the possible formation of zeolitic minerals during the process of decomposition and their efficacy as conservators of potash, as suggested by Lemberg and Hilgard.

A series of analyses formed the basis of the remarks and showed the great loss in silica, alkalies and alkaline earths which the process had caused, while the alumina and iron oxides had largely remained. Alumina was assumed as the constant member and calculations were based on its permanence. The analyses, when recast on this basis, furnished the ground for very interesting deductions. The speaker had been led by his investigations to question the efficacy of zeolites as conservators of alkalies. A series of specimens in tubes were passed around which had been obtained by washing a sample of a given weight and settling it so as to separate the constituents according to sizes. The chief red coloring ingredient was found in the finest sediment of all. The altered Medford diabase, as well as the rock specially the subject of the paper, were illustrated in this way. The sorting had been done by Prof. Whitney, of the Department of Agriculture. In discussion J. F. Kemp remarked the permanence of iron oxide in process of alteration, which was surprising, as iron is a characteristically restless migrator, and also that phosphoric acid remained constant, whereas in stock piles of Lake Superior hematite, it may be largely leached from the upper portions to the lower in a single season. L. V. Pirsson emphasized the care that is necessary in determining alumina and mag-

nesia, the latter being often weighed with the former. He cited cases of such error, especially in German analyses. Mr. Merrill, in reply, regarding migrating iron oxide, stated that where air has free access, iron is permanent, but that below the surface it is a very restless member. As for phosphoric acid its quantity is small and it is a peculiar ingredient, not always acting the same in different suites of analyses.

Mr. Merrill's paper was a suggestive and important one and has a close bearing on the origin of soils.

The Age of the White Limestone of Sussex Co., N. J. J. E. Wolff, Cambridge, Mass., and A. H. Brooks, Washington, D. C.

After a brief review of previous work and opinions regarding this question, the authors gave the results of their own detailed work which led them to believe that the limestone is of *pre-Cambrian* age. By means of a map the areas throughout Sussex county, N. J., were outlined and the location of crucial sections indicated. These were separately plotted and interpreted as indicating fault lines along which the blue and white crystalline limestones had become mixed up together, affording apparent transitions. The thin bed of quartzite that lies below the blue Cambrian limestone was found extremely serviceable as an aid in stratigraphic work. The outcrop of it that dipped into the white limestone east of the Buckwheat mine had been shown by a recent quarry to run down into the latter, to be tapering off and to contain limestone boulders. It was regarded as produced by the filling of a crevice by the advancing sediments. The ore body was interpreted as interstratified in the limestones because its elongation conformed to the pitch of the foliation of the the metamorphic rocks. Eruptive granites cut all the latter, although not the Cambrian limestone. In discussion J. F. Kemp spoke of the difficulties of the problem and the gratification all must feel to have the relations so well explained. Although the evidence at Mt. Adam and Mt. Eve had seemed to him to favor the metamorphism of the blue limestone there, he had felt able to go no further than probability in the matter. He also commented on the very puzzling nature of the ore bodies and the strong probability that they were replacements.

The section then adjourned for lunch.

When the section reassembled after lunch the first paper read was the following presented by F. D. Adams.

Origin and Relations of the Grenville-Hastings Series in the Canadian Laurentian. F. D. Adams and A. E. Barbour, with an added note by R. W. Ells.

The paper sketched the distribution of the fundamental gneisses in Canada. In the field recently covered in Ontario the rocks were described in detail and as constituting plutonic members of various acid and basic types, now stretched and gneissoid. A map was used to show the areal distribution. The contact of the Grenville series and the fundamental gneiss is an igneous one. The carrying of the work over the intervening belt to the Hastings areas gives ground for thinking that the Grenville consists of portions of the Hastings which have become involved in the fundamental gneiss during the intrusions of the latter. There has been more or less absorption by infusion of the Grenville into the gneissic magma. An added paper by R. W. Ells described an area to the westward where similar conclusions have been reached.

In discussion C. H. Smyth, Jr., remarked the coincidence of the views expressed with his conclusions in the western Adirondacks. J. E. Wolff asked for further particulars regarding the field evidence of the intrusion of the fundamental gneiss into the lime-

stone. He also spoke of the enrichment of metamorphic rocks in the Hoosick region with albite, and therefore with soda, necessitating caution in the interpretation of analysis. Mr. Adams, in reply, described the Grenville series as made up of closely involved limestones and gneisses, the latter exactly like the fundamental ones. He stated that pegmatite dikes cut the limestones in every direction. He also said that his analyses, on which the conclusions regarding the sedimentary origin of certain of the later gneisses were based, had shown such low alkalies and high alumina as to warrant it. There could, therefore, have been no enrichment with soda. Mr. Cross cited, in comparison, the granites and gneisses of the Rocky Mountains. Mr. Iddings questioned the fact of the fundamental gneisses being the original crust. Dr. Adams replied urging its world-wide extent and fairly uniform acid character despite some more basic members. Prof. Emerson remarked on the distinction that was made between intruded fundamental gneiss regarded as older than the limestones and intruded lavas that would be called later. He raised the point that both were practically the same and that if an intruded lava were called a later rock, although it had existed in the interior, perhaps from very early time, then gneisses now found intruded should also be regarded as later. Dr. Adams, in reply, urged the conception of the original crust, and insisted that, even if after the Grenville-Hastings series had been laid down on it the great batholite softened and penetrated them, it was still to be considered older. The section evidently held diverging views on this point.

The Crystalline and Metamorphic Rocks of Northwest Georgia. C. WILLARD HAYES and ALFRED H. BROOKS, Washington, D. C.

The region discussed in the paper extends southward one hundred miles from the Tennessee line and westward twenty to eighty miles from the Atlanta meridian. It embraces about 4,000 square miles, forming a belt to the east and south of the Georgia-Alabama Paleozoic area. The rocks described consist of (1) the slates and conglomerates of the Ocoee series, (2) the granites, gneiss and crystalline schists of the Piedmont basal complex, and (3) a series of intrusives including granite, diorite, gabbro.

By means of maps colored to show the distribution of the rocks, their areal relations were outlined and many interesting points were adduced, not the least of which were those connected with the intrusive granites, so prominent east of Atlanta at Stone Mountain.

Dr. A. C. Lane asked about the intruded rocks and if there were contact zones. Mr. Brooks replied that there were zones of ottrelite and andalusite schist around both granites and diorites. Mr. Keith also inquired about certain stratigraphical relations.

The Grain of Rocks. ALFRED C. LANE, Houghton, Mich.

The grain of rocks is dependent on the chemical composition and the causes that produce solidification, cooling, gas diffusion, etc., the general law being, the more rapid the action the finer the grain. The paper discussed the grain from the threefold standpoint of theory, observation upon the Keweenawan rocks and experiment.

In regard to chemical composition, the augite of the melaphyres shows plainly the empirical law that the less there is of it the finer is the grain, other things being equal.

The mathematical laws of cooling were applied to an indefinite sheet and the following laws deduced and tested:

(a) The case where we consider the adjacent rock symmetrically heated by the

sheet can be solved by aid of a solution for the case wherein the walls are kept at a fixed temperature. For the temperature at any point of the affected zone is the same as an average temperature obtained from two points as follows: If we imagine a hypothetical dike of the same breadth as the zone affected in the original sheet, and conceive of its walls being kept at a constant temperature, and if we imagine the two points situated at the same distance from the walls of the dike as was the original point whose temperature was sought in the original sheet, the average of the temperatures of the two points will be the value sought. The sum will be used when the original point lies within the hypothetical dike, and the difference if it lies without. We need, therefore, to consider in detail only the case where the sides of the sheet are kept at a fixed temperature.

(b) Taking therefore this case of a sheet originally of a uniform temperature we can divide the cooling into three periods:

1. Before the center has cooled appreciably. During this time the time of cooling is as the square of the distance of the margin, and is otherwise independent of the sheet.

The augite of the Keweenawan ophites follows in its grain this law, the average area of cross sections being proportional to the square of the distance from the margin and independent of the size of flow. Consolidation in this period may be expected to be especially characteristic of effusive rocks.

2. While the center is cooling down one-fourth of original difference in temperature between sheet and margin. This period is about four times as long as the first.

3. Thereafter the rate of cooling when a given temperature is reached will be independent of the position of a point. Hence the grain will be uniform and the same for all parts of the sheet that consolidate in this period. The solidification will tend to to fall into this period for high initial temperatures of the magma and hot walls, compared with the temperature of solidification and broad contact zones. Hence solidification in this period may be taken as typical for abyssal rocks.

Dikes of the Keweenawan in the Huronian show a marginal zone where the grain appears to have been formed in the first period of solidification, and a central belt where the solidification appears to have been in the third period. Throughout, the augite follows the theoretical laws most sharply, while porphyritically formed components are less tractable.

In illustration the speaker showed the results of experiments with sulphur and with candy, and found that they corresponded to his propositions. Slides were passed around, made from luster-mottled melaphyrs to bring the points out. (The abstract of Dr. Lane's paper is somewhat obscurely worded under (a), and it is possible that the undersigned has not accurately expressed it. The direct application lies in this: If we can measure in a diabasic dike or sheet the distance of the zone of even grain from the walls, then, knowing as we do the fusing point of augite, we can calculate the initial temperature of the dike or sheet at time of intrusion.)

In the concluding paper of the session Prof. Emerson described some peculiar phenomena that he had observed in the trap sheets of the Connecticut Valley. In certain flows, mud in streams and chunks had become so involved that it had made the trap a mass of glass and sediments. Steam, supposed to have been evolved from wet rocks under the lava flow by its heat, had boiled up through the lava and made other curious mixtures. These and the alterations resulting were described and illustrated by thin sections.

The Section then adjourned and joined the rest of the Society.

The following titles were also announced, but were not read, chiefly because of the absence of their authors. In several instances they were read by title:

Evidences of Northeasterly Differential Rising of the Land along Bell River. ROBERT BELL, Ottawa, Canada.

Surface Tension of Water as a Cause of Geological Phenomena. GEORGE E. LADD.

Geomorphy of Jamaica as Evidence of Changes of Level. J. W. SPENCER, Washington, D. C. (By title.)

Preliminary Note on the Pleistocene History of Puget Sound. BAILEY WILLIS, Washington, D. C.

Modified Drift in St. Paul, Minn. WARREN UPHAM, St. Paul, Minn.

Note on Plasticity of Glacial Ice. I. C. RUSSELL.

Physical Basis for General Geological Correlation. CHARLES R. KEYES, Jefferson City, Mo.

Notes on the Potsdam and Lower Magnesian Formations of Wisconsin and Minnesota. JOSEPH F. JAMES, Hingham, Mass.

The Age of the Lower Coals of Henry County, Missouri. DAVID WHITE.

New Evidence on the Origin of Some Trap Sheets of New Jersey. HENRY B. KUMMEL, Chicago, Ill.

The Origin and Age of the Gypsum Deposits of Kansas. G. PERRY GRIMSLEY, Topeka, Kansas. Read by title.

On the whole the meeting was a most enjoyable one, and the 75 to 100 Fellows who were in attendance returned to their homes with appreciative and grateful feelings to the geologists of Washington, by whom they had been so hospitably entertained.

J. F. KEMP.

AMERICAN MATHEMATICAL SOCIETY.

THE annual meeting of the American Mathematical Society was held in Hamilton Hall, Columbia University, on Wednesday afternoon, December 30, 1896. The President, Dr. George W. Hill, occupied the chair, and there were twenty-four members in attendance. Profs. T. W. Edmondson and J. L. Patterson were elected to membership. The Secretary's report showed a total membership of 279, being a net gain of 12 for the year. Reports were also received from the Librarian and the Treasurer. The *Bulletin* of the Society has appeared regularly through the year, being at present in the sixth annual volume. The last complete volume is a substantial octavo of 354 pages.

The annual election was held at this meeting, the following ticket being adopted: President, Prof. Simon Newcomb; Vice-President, Prof. R. S. Woodward; Secretary, Prof. F. N. Cole; Treasurer, Prof. Harold Jacoby; Librarian, Prof. Pomeroy Ladue; Committee of Publication, Prof. T. S. Fiske, Prof. Alexander Ziwet, Prof. Frank Morley; Members of the Council to serve until December, 1899, Prof. Alfred Baker, Dr. George W. Hill, Dr. Emory McClintock.

Three papers were presented, abstracts of which are given below.

Prof. Morley, of Haverford College, read a paper on the construction of a single point covariant with five given points. Taking the five points 1, 2, 3, 4, 5 on a conic, U, and taking Gundelfinger's conic for any four, let the intersection of the polars of the fifth point with respect to the two conics be found; the 5 points so obtained lie on a line which strikes U at the zeros of a quadratic covariant, Salmon's S. By taking the polar of the five points with regard to this covariant pair, counted thrice, we obtain a covariant point, readily identified as the second of Salmon's list. For

this a geometric construction was given. The constructions involve the ruler alone, as is proper when a single point is to be found.

Prof. Alexander S. Chessin, of the Johns Hopkins University, gave a brief account of his investigations on the motion of a physical pendulum, taking into account the rotation of the earth about its axis. He showed that when the relative velocity of the pendulum is zero, as in the famous experiment of Foucault, the motion of the axis of the pendulum can be represented as composed of two simultaneous motions: (1) of the motion on a very flat closed conic surface, this surface having a plane of symmetry which would be the plane of oscillations of the pendulum, but for the disturbance due to the rotation of the earth; and (2) of the rotation of this conic surface about the vertical of the point of suspension.* The conic surface being very flat, it will seem to an observer as if the axis of the pendulum oscillated in the plane of the vertical of the point of suspension, while at the same time this *apparent* plane of oscillations rotated about the vertical. In Foucault's experiment the rotation of the apparent plane of oscillations took place *clock-wise*. Prof. Chessin showed that this rotation depended on the construction of the pendulum; namely, if the pendulum be properly constructed and the amplitude of oscillations be sufficiently great, then the rotation of the apparent plane of oscillations could take place as well *clock-wise* as *contra clock-wise* or even *not take place at all*. This interesting phenomenon could be observed best at places near the equator, because the angular velocity of rotation of the apparent plane of oscillations is composed of two terms, one proportional to the *sin*, the other to the *cos* of the latitude of the place of observation. The contra clock-wise rotation is due to the presence of the cosine term and is maximum on the equator. In concluding, Prof. Chessin emphatically urged experiments which would verify his calculations.

Prof. E. W. Brown, of Haverford College, made a brief statement of the progress of his calculation of the solar inequalities in the lunar theory. The motion of the node was compared with Hansen's result and with that given by observation. An explanation was also given of the slow convergence of the series which represents the principal part of the secular acceleration of the moon's mean motion.

Following a pleasant custom of previous years, several of the members dined together after the meeting.

F. N. Cole,
Secretary.

* See *American Journal of Mathematics*, Vol. XVII., p. 86; Johns Hopkins University Circulars, Vol. XIV., No. 118, p. 64.

CURRENT NOTES ON ANTHROPOLOGY.

DIVINATORY AND CALENDRICAL DIAGRAMS.

At the American folk-lore meeting Mr. Stewart Culin exhibited and explained several divinatory diagrams from Thibet, China and Corea, and called attention to their close similarity to the so-called 'calendar-wheels' and the *tonalamatl*, or book of days, of ancient Mexico. He pointed out that the fundamental conceptions of both are identical, and that both developed into games, such as *parcheesi* in India and *patolli* in Mexico, the Chinese game of 'promotion,' and the European 'game of goose.'

These all begin with the numerical concept of the four, expressed in four arms, like a cross, or four 'houses' or squares, which latter, by multiplication, may be 12, 16, 64, etc. This primary concept expressed the original notion of the 'four quarters,' *i. e.*, of the world, and, by extension of the cosmos, time as well as space. The relation of each individual to the All was the notion which imparted the divina-

tory character to the diagram, and was as common in Central America, where it gave rise to the sacred 'year' of 260 days, as in many parts of the Old World. Such calendars were not originally time-measurers, but divining schemes, as Sahagun expressly states.

THE RACIAL GEOGRAPHY OF EUROPE.

THE complex and historically important subject of the geographical distribution of racial types in Europe has been closely studied by Prof. W. Z. Ripley, and will be made the theme of a series of articles in the *Popular Science Monthly*, beginning with the February number. The articles will be amply illustrated by maps, diagrams and some fifty hitherto unpublished portraits of race types reproduced from original photographs. Having had the advantage of looking through Prof. Ripley's collections upon this branch of anthropology, I feel sure his articles will add much new material and many valuable suggestions to a comprehension of the racial questions of modern Europe. Such points as the cephalic indices, the distribution of blonds and brunettes, the comparison of stature and weight, etc., when studied from hundreds of thousands of individual measurements, must lead to results more secure, and perhaps quite differing from those hitherto published.

D. G. BRINTON.
UNIVERSITY OF PENNSYLVANIA.

NOTES ON INORGANIC CHEMISTRY.

IN the last number of the *Chemical News*, Prof. John Waddell, of the Canadian Royal Military College, describes a large number of experiments on the permeability of various elements to the Röntgen rays. He concludes "that the elements may be divided into two classes, those of low atomic weight and those of higher atomic weight, the transition taking place between the atomic weights of 30 and 40. Among the higher elements the opacity is probably not far from being proportional to density, but with elements of low atomic weight the same law does not hold; sodium, for instance, is decidedly more permeable than aluminum; lithium and sodium are more nearly alike. Metals and non-metals cannot be differentiated from each other; boron is less permeable than sodium, and sodium is less permeable than oxygen."

THE cause of poisoning from wall papers containing arsenic has often been ascribed to the formation of arsin (arsenetted hydrogen) by the action of mould on the paper. An account is given in the last Berichte of a number of experiments carried out by O. Emmerling bearing on this subject. Several different kinds of bacteria were grown in cultures containing arsenic, and in no case was arsin present in the gases evolved. The same was true when several different species of moulds were used. A moist arsenical paper was exposed in a tube in a current of air till it had on it numerous colonies of moulds, yeasts and bacteria. The air was drawn through a silver nitrate solution and no trace of arsin was present. Hence it would seem that danger from arsenical wall papers is not from the formation of arsin, but from particles of dust given off from the paper. Happily, few wall papers are at present manufactured containing arsenic.

IN a letter to *Nature* (Nov. 26), on the subject of osmotic pressure and ionic dissociation, Prof. Henry E. Armstrong uses these words: "There can be no doubt that in so far as *weak solutions* are concerned, a law has been discovered which is broadly true *in mathematical form;* yet I have no hesitation in asserting that the fundamental premises on which it is based are destitute of common sense, in the opinion of those who look at these matters without leaving chemical experience out of ac-

count." "I am a determined opponent of what I think may fairly be termed the *nonsensical hypothesis of ionic dissociation* (italics ours), for there is no other appropriate term for a view which asserts that hydrogen chloride and a few other compounds are so loosely strung together that they fall to pieces when dissolved in water; out of sheer fright, it would seem, as no valid motive is suggested for such self-sacrifice; and no such charge of unprincipled levity of conduct is brought against the vast majority of compounds other than a few acids and alkalies." If there are others who oppose the theory as strongly as Prof. Armstrong, they at least have not the temerity to attack it so boldly in the face of its tacit general acceptance in the chemical world.

In the December Journal of the American Chemical Society, George F. Payne discusses the mineral constituents of the watermelon. He finds in the ash over sixty per cent. of potash and ten per cent. of phosphoric acid; hence the need of fertilizers containing a large quantity of potash.

J. L. H.

ASTRONOMICAL NOTES.

We have received a new book on the determination of planet and comet orbits by Dr. Karl Zelbr. It contains 125 octavo pages, and is reprinted from the first volume of Valentiner's *Handwörterbuch der Astronomie.* It will doubtless be found a very useful text-book of the subject.

The *Astronomical Journal* of December 10th contains a series of observations of the companion of Sirius made at Washington last March by Prof. Stimson J. Brown. At the time of making these observations Prof. Brown did not consider them entitled to very much confidence, on account of the extreme difficulty experienced in seeing the companion so near the principal star. It is now evident, however, from the later observations at the Lick Observatory, that the Washington observations are correct, and that the object seen by Prof. Brown was really the companion.

In the *Astronomische Nachrichten* of December 14th Prof. E. C. Pickering has a note on a method of determining the relative motions of stars in the line of sight by means of spectra photographed through an objective prism. The plan consists of making a pair of photographs of the same region near the meridian in reversed positions of the telescope. As the reversal of the telescope turns the spectra 180°, we can measure on the photographs twice the linear displacement due to the relative motions of any two stars in the line of sight. The second photograph is made through the glass plate, so that the plates may be placed with their films in contact for making the comparisons.

Among recent series of meridian circle observations of which preliminary accounts have appeared in the astronomical periodicals, we notice the following: In the *Astronomical Journal* of December 23rd Prof. Tucker gives a summary of the results of his determinations of fundamental stars contained in the astronomical ephemerides other than the *Berlin Jahrbuch.* In the *Astronomische Nachrichten* of December 22d Prof. Küstner gives his determinations of the *Zusatzsterne* of the *Berlin Jahrbuch* list, made with the meridian circle of the Berlin observatory in the years 1886 to 1891.

H. J.

SCIENTIFIC NOTES AND NEWS.

Gen. Francis A. Walker, President of the Massachusetts Institute of Technology and Vice-President of the National Academy of Sciences, died suddenly on January 5th. He was born on July 2, 1840, and graduated from Amherst College in 1860. He had filled many important positions, having been professor of political economy in the Sheffield Scientific School of Yale University, Chief of the Bureau

of Statistics, Superintendent of the Census and Commissioner of Indian Affairs. Gen. Walker made numerous and valuable contributions to statistics, sociology and political economy.

WE regret also to announce the deaths of Dr. Joseph v. Gerlach, formerly professor of anatomy in the University at Erlangen; of Dr. Charles Heitzmann, the distinguished New York histologist; of Prof. Wm. H. Pancoast, an eminent Philadelphia surgeon; of the Count de Mas-Latre, the author of numerous contributions to paleography; of Mr. W. H. Ward, of Newark, N. J., a student of horticulture; of Mr. Vivian S. Martin, the geographer, and of Sir John Brown, who made important improvements in the manufacture of armor plates and railway supplies.

QUEEN VICTORIA has conferred an honor on the English peerage by making Sir Joseph Lister a lord.

PROF. FRANCIS DARWIN is preparing to publish a supplementary series of Charles Darwin's letters. His projected volume will include a full selection from those letters of a purely scientific interest which he was unable to print in the 'Life and Letters,' as well as from any fresh material that may now be intrusted to him. Those of Darwin's correspondents who have not already done so are requested to allow him to make copies of any letters of his which they possess, even though they are apparently of only slight or restricted interest.

MR. HERBERT SPENCER has consented, in response to a letter signed by a large number of eminent Englishmen, to allow his portrait to be painted and presented to the nation. Mr. Hubert Herkomer has been selected as the artist.

THE Arago medal, so seldom given by the Academy, was this year awarded both to Lord Kelvin and to M. Antoine d'Abbadie.

THE public meeting of the Paris Academy of Sciences on December 21st was of special importance. An address was made by the President, M. A. Cornu, and the prizes of the Academy were awarded. These prizes are very numerous and valuable, and the issue of the *Comptes Rendus* containing the account of their award is of much interest. The grounds of each award is given in detail by an eminent authority, and the hundred pages of the number thus give a valuable summary of the advances in certain departments of science.

THE Royal Geographical Society of London has awarded a special gold medal to Dr. Fr. Nansen and special silver medals to Captain Sverdrup, Lieutenants Scott-Hansen and Johannsen and to Dr. Blessing. The other members of the recent Polar expedition were each awarded bronze medals.

IT is now reported that the large fortune left by Alfred Nobel will be used to endow five international prizes to be awarded annually, one of these for the most important advance in physics, one in chemistry, one in physiology or medicine, one for the best compilation in physiology or medicine, and one for the most important contribution towards the promotion of peace.

MR. JOHN LEIGHTON will present to the Royal Institution, London, his collection of letters and papers by Faraday, which consist chiefly of letters written to Frederick Magrath. Faraday left his personal papers to the Royal Institution, and they now are contained in a special cabinet.

THE trustees of the British Museum have secured the important collection of woodpeckers and other birds formed by the late Mr. Edward Hargitt. The number of specimens of woodpecker alone is nearly 3,600, including all the valuable types described by Mr. Hargitt in his 'Catalogue of the Woodpeckers,' and there are also 2,000 miscellaneous birds.

MRS. COXE has presented the scientific library of the late Eckley B. Coxe to Lehigh University. The collection is rich in complete sets of scientific periodicals and in the transactions of learned societies.

THE foreign papers contain detailed accounts of the interment of Pasteur at the Pasteur Institute on December 26th. His remains had for fifteen months been lying at Notre Dame, where a religious ceremony was held before removing them to the Institute. The crypt, planned by M. Giraud, following the tomb of Galla Placadia at Ravenna, is inscribed with a sentence from Pasteur's reception speech at

the Academy: "Heureux celui qui porte en soi un dieu, un idéal de beauté, et qui lui obéit—idéal de l'art, idéal de la science, idéal de la patrie, idéal des vertus de l'évangile." Brief remarks were made by M. J. B. Pasteur; M. Bertrand, President of the Council; M. Rambaud, Minister of Education; M. Bodin, President of the Municipality; Sir Joseph Lister, representing the Royal Society; Sir Dyce Duckworth, Sir John Evans, Prof. Crookshank, Sir. W. Priestley, representing the Universities of Edinburgh and St. Andrews; M. Cornu, for the Academy of Sciences; M. Bergeron, for the Academy of Medicine; M. Perrot, for the Normal School; M. Louis Passy, for the Agricultural Society; M. Tissier, for the medical students, and M. Duclaux, Director of the Pasteur Institute.

The *British Medical Journal* states that the question of the appointment to the chair of physiology in Geneva, vacant by the death of Prof. Moritz Schiff, is exciting some attention in Paris. Amongst the candidates are stated to be Prof. Herzen, of Lausanne; Prof. J. R. Ewald, of Strassburg, son-in-law of Prof. Schiff; Dr. Langlois, assistant in the Physiological Department of the Medical Faculty in Paris under Prof. Richet, and well known for his researches on heat and the suprarenal capsule; Dr. Contjean, one of the staff at the Museum, under Prof. Chauveau, known for his researches on secretory nerves and his other contributions to physiology. Other names are mentioned, but it is evident that with Prevost as a possible successor, and the candidates already mentioned, a worthy successor to Schiff will readily be found.

Dr. Charles Wardell Stiles has been appointed by the State Department a special commissioner to report on the parasitic diseases of seal life.

The government of Western Australia decided about a year ago to erect an observatory at Perth at a cost of $25,000. Mr. Ernest Cooke, the government astronomer, has recently been in England purchasing the necessary instruments.

A remarkably violent cyclone has practically demolished the town of Nevertire in New South Wales. The casualties were numerous, but are not fully known, as the telegraph line has been destroyed.

A landslide has occurred at the village of Stanna, in the province of Modena, Italy, destroying a large number of buildings.

A series of lectures and conferences upon the educational value of science in the common schools will be held at Teachers' College, New York, as follows:

The educational value of biological science (botany, zoology and physiology). Prof. Henry F. Osborn, of Columbia University. January 14th, 3 p. m.

The educational value of physical science (physics and chemistry). Prof. Ira Remsen, of Johns Hopkins University. Thursday, January 21st, 3 p. m.

The educational value of geological science. Prof. B. K. Emerson, of Amherst College. Thursday, January 28th, 3 p. m.

The Curriculum. Pres. J. G. Shurman, of Cornell University. Friday, January 29th, 3 p. m. (This date is liable to be changed.)

The lecture in each case will be one hour in length, followed by a conference lasting, perhaps, one hour. The purpose of these lectures and conferences is (1) to arouse due appreciation of the study of science, (2) to give helpful suggestions to those who are engaged in teaching science, and (3) to aid in determining the relative importance of these subjects in courses of study.

Prof. Daniel G. Brinton will deliver a course of six lectures on 'The Religions of Primitive Peoples,' at New York University, on successive Tuesday evenings, beginning January 12th, at 8 p. m. The lectures will be published by G. P. Putnam's Sons, as Volume II. of the Series of American Lectures on the History of Religions.

Natural Science expects to publish next month an account of flints discovered by Mr. J. Lewis Albert and exhibited at a recent informal smoking evening of the London Geological Society. They are said to be the work of man, though obtained from the Cromer Forest bed at Runton, regarded as forming the top of the Pliocene Series. No one has hitherto professed to find in Great Britain the remains of man at so low a horizon.

The article entitled 'Biographical Notes on

Pasteur' by Dr. Jules Marcou, published in the issue of this JOURNAL for December 6, 1895, has been translated into French and Spanish and has been distributed by order of the government of Nicaragua to all schools and public institutions of that state.

PROF. HOLDEN will contribute to an early number of *Harper's Weekly* an illustrated article on the Lick Observatory.

MR. J. E. HARTING has resigned from the editorship of the *Zoologist*, which he has conducted for twenty years, and is succeeded by Mr. W. L. Distant.

AT the beginning of the new year the *Naturwissenschaftliche Rundschau*, edited by Dr. W. Sklarek and published by Friedrich Vieweg & Sohn, Brunswick, announces as cooperating editors Dr. J. Bernstein, professor of physiology at Halle; Dr. W. Ebstein, professor of pathology at Göttingen; Dr. A. v. Koenen, professor of paleontology at Göttingen; Dr. Victor Meyer, professor of chemistry at Heidelberg, and Dr. B. Schwalbe, professor of anatomy at Berlin. The new volume is printed on improved paper, presenting a much more pleasing appearance than is usual in German publications. The *Naturwissenschaftliche Rundschau* usually contains one scientific paper, but is chiefly made up of reviews of scientific literature, written with care and impartiality and giving an excellent survey of the progress of science.

THE British government will send, in January, a commission, consisting of General Sir Henry Wylie Norman (Chairman), Sir Edward Grey, Bart., and Sir David Barbour, to inquire into the conditions and prospects of the West India sugar-growing colonies. Mr. Daniel Morris, Assistant Director of the Royal Gardens, Kew, will accompany the commission as expert adviser in botanical and agricultural questions. *Nature* calls attention to the fact that the appointment of Mr. Daniel Morris as scientific adviser is a proof that Kew has been working for the last quarter of a century on the right lines and that its policy is a sound one. Of all the colonies in the West Indies, Jamaica is said to be the only one in a fairly prosperous condition. This has been brought about mainly by the work of the Botanical Department and the encouragement given by it to improve agricultural methods and introduce new industries.

PROF. RICHARD E. DODGE, Teachers' College, New York, will edit a *Journal of School Geography*, the first number of which will appear during the present month. Prof. Dodge will be assisted by a board of editors consisting of William M. Davis, professor of geography at Harvard University; Dr. C. W. Hayes, geologist of the U. S. Geological Survey; Dr. H. B. Kümmell, Lewis Institute, Chicago, Ill.; Dr. F. M. McMurry, of the School of Pedagogy at Buffalo, and Mr. R. DeC. Ward, instructor in climatology at Harvard University. The journal will be issued monthly, with the exception of July and August, and each issue will contain about thirty-two pages of reading matter. Specimen copies will be sent, so far as the edition will allow, on application to Prof. Dodge.

THE current number of *Natural Science* gives the following news concerning recent scientific expeditions: Prof. Penzig, of Genoa, editor of *Malpighia*, has undertaken a botanical expedition to Buitenzorg, Singapore and Ceylon. Dr. Grünling, Curator of the Mineralogical Collection in Munich, has gone to Ceylon on an exploring expedition. Mr. Bastard, who is exploring in Africa, has been prevented by the trouble in Madagascar from penetrating into the interior or that island. He has, however, made good collections of fossils, also anthropological measurements and photographs. Mr. Voillot has returned from a voyage to Haute Mamberé; he brings with him ten Baya skulls and an interesting ethnographic collection. Another valuable anthropological collection is that brought back from Russian Asia by Mr. E. Blanc. Of Mr. Alexander Whyte's explorations in the Karonga Mountains in Central Africa, the results include 6,000 dried specimens of plants, 5,000 land shells, 3,000 insects, numerous mammals, reptiles, geological collections, and so on.

FELIX ALCAN, Paris, has begun the publication of a *Bibliographia Physiologica*, compiled by Prof. Ch. Richet and several assistants. The bibliographies for 1895 and for the first half of

1896 have been issued nearly simultaneously, and it is proposed not only to continue their publication, but also to cover preceding years. Prof. Richet is a zealous advocate of the Dewey decimal system of classification and applies it systematically in the new bibliography. It is printed on one side of the paper only, and the index numbers, sometimes extending to six decimals, are prefixed to each entry. A special volume has been issued giving the classification for physiology, which is somewhat bewildering, as the fifteen hundred publications indexed for a year may be divided among one million classes. When the entries are cut up and made into a card catalogue different years may be combined conveniently, but the separate volumes lose half of their usefulness in that they have no alphabetical index of authors' names. The *Bibliography* is confined to physiology in its narrower sense, excluding subjects such as embryology, histology and bacteriology. There are naturally omissions and errors, but the *Bibliography* will serve a most useful purpose pending the establishment of an international bibliography of the sciences.

At a meeting of the Boston Society for Medical Sciences on December 15th Dr. C. S. Minot described an improved microtome, made for him bythe Bausch and Lomb Optical Company, which is entirely novel in its construction and works with great precision. The model adopted has been chosen: 1st. To secure the utmost steadiness and precision of movement, together with the minimum of errors. To this end, the knife is rigidly clamped at both ends upon a heavy metal frame above the object, and it can be placed in any position and at any desired angle. The object holder is supported under the the knife in such a way that the knife exerts no leverage upon the object. Every part is heavily built and the ways are planed and ground to the greatest possible accuracy. 2d. To secure convenience of use, the micrometer screw bears two toothed wheels, one for automatic movement, each tooth equaling five microns, and one for hand movement by lever, with automatic adjustment, each tooth equaling two microns. The object holder is adjustable by rack and pinion in three places, and has clamping devices for clamping each of the axes and is adjustable for height also. 3d. To make a microtome to work equally well for either paraffine cutting or with alcohol (celloidin, etc.). By a simple device, alcohol falling on the object is drained off without coming in contact with the ways or micrometer screw. The knife possesses the following advantages due to the handles, being of the same cross-section as the blade; the edge is true and, being made by polishing and not by grinding, is much finer than can be ordinarily produced. Every part of the edge can be actually used for cutting in the microtome. The edge may be kept always perfect by rubbing the blade on a piece of plate-glass with Diamatine powder.

At the annual public meeting of the Paris Académie de Médecine held on December 15, 1896, the prizes offered for competition during the past year were awarded. The Saint Paul prize ($5,000), as we have already stated, was divided between Drs. Roux and Behring. *The British Medical Journal* states further that the Academy prize (£40) for an essay on the part played by heredity and contagion respectively in the propagation of tuberculosis was divided between M. Georges Kuss and Dr. Aussett. The Capuron prize (£56) for an essay on the influence of diseases of the lungs in the mother upon the health of the fœtus was awarded to Dr. Chambrelent, of Bordeaux; the Civrieux prize (£40) for an essay on hallucination in mental diseases to Dr. Paul Sérieux; the Daudet prize (£40) for an essay on membranous nondiphtheritic anginæ to Dr. Jacquemart. The Falret prize (£36) for an essay on morphinism and morphinomania was divided between MM. Jacquemart, Paul Rodet, André Antheaume and R. Leroy. The Orfila Prize (£80) for a paper on the etiology of dysentery was awarded to Surgeon-Major M. O. Arnaud. The Portal prize (£30) for an essay on the lymphatic system in its relation to malignant neoplasms was divided between M. et Mme. Christiani, of Geneva, and MM. F. Barjon and C. Regaud, of Lyons. The Pourat prize (£40) for an essay on the relations between thermogenesis and the respiratory exchanges was awarded to M. F. Laulanié. The Laborie prize (£200) was divided between MM. Delorme, Mignon and Mauclaire. Other prizes, to the amount of

about £1,600, were distributed among various competitors, almost exclusively of French nationality.

THE following table gives the number of students from the different medical schools who passed the licensing examinations now required in the State of New York for the year ending in 1896:

Schools.	Number of Candidates.	Honor.	Per cent. accepted.
University of the State of New York	2	1	100
New York Medical College and hospital for women	7	0	100
College of Physicians and Surgeons, Columbia University	142	11	92.9
Syracuse University	24	0	91.6
Bellevue Hospital Medical College	47	3	89.3
University of Buffalo	36	0	89.2
Long Island College Hospital	64	0	87.5
Niagara University	15	0	86.6
Woman's Medical College of the New York Infirmary	7	2	85.7
Albany Medical College	47	0	85.1
Eclectic Medical College	20	3	85
New York Homeopathic Medical College	27	3	81.4
New York University	79	2	75.9

THE report of the special commission appointed by the Dutch government to discuss the scheme of draining the Zuyder Zee has been submitted. According to the *Railway Review* it states that such an undertaking is quite possible. The work would take 31 years for completion, and every year 10,000 hectares of land would be restored to cultivation. A dike 30 miles in length would have to be constructed, extending from the extreme end of South Holland to the eastern coast of Friesland. The building of this dike, 35 meters wide at the base and six meters high, will take nine years. The total cost of the work is estimated at £26,000,000, which includes the amount to be paid in indemnities to the fishermen of the Zuyder Zee. The total value of the land thus reclaimed from the ocean is estimated at £27,000,000, so that the Dutch treasury net a profit of £1,000,000, without reckoning the substantial gain to the public wealth and a corresponding increase in the annual revenues from duties and taxes.

UNIVERSITY AND EDUCATIONAL NEWS.

THE Rev. Thomas J. Conaty will be installed as Rector of the Catholic University, Washington, on January 19th. It is expected that Dr. Conaty and Cardinal Gibbons will make important speeches outlining the policy of the University.

EX-SENATOR SAWYER, of Wisconsin, has added $5,000 to his recent gift of $25,000 to the endowment fund of Lawrence University, in Appleton, Wis.

PROF. CHARLES F. CHANDLER has retired from the professorship of chemistry and medical jurisprudence in the College of Physicians and Surgeons, but retains the professorship of chemistry in Columbia University. Prof. Thomas Egleston has retired from the chair of mineralogy and metallurgy in Columbia University, and has been made professor emeritus.

DR. KLEBS, the German pathologist, has been made professor in the Rush Medical College, Chicago, and will also occupy a position in the post-graduate medical school of the University of Chicago.

A SCHOOL of science, with twenty-seven professorships, has been founded at Madrid.

THE following appointments are announced: Dr. G. H. Bryan to be professor of pure and applied mathematics in the University College of North Wales, Bangor; Prof. E. Pringsheim to be professor of physics and Dr. Karl Friedheim to be professor of chemistry in Berlin University; Prof. Paul Staeckel, of Königsberg, to be professor of mathematics in the University of Kiel; Dr. Franz Nissl to be docent in anatomy in the University of Heidelberg.

DISCUSSION AND CORRESPONDENCE.

ON CERTAIN PROBLEMS OF VERTEBRATE EMBRYOLOGY.

I CRAVE your permission to rectify certain mistakes into which the reviewer of my recent work has fallen in his notice in SCIENCE of November 20th (p. 763). Your reviewer makes the following statements:

(1) "So far as has yet appeared, this theory (of antithetic alternation of generations in Metazoan development) rests upon the author's observation that the epidermis contributes, in early embryonic stages, to the production of nerve cells. The transformations of these cells *he has not followed*," etc., (2) "hence the whole embryo is a transient structure," etc.

(3) "The author discourses at length upon the well-known fact that in all vertebrates there is an embryonic period, at the close of which the anlages of all the principal organs are present, but not yet differentiated."

(4) "We have been unable to see that the elementary facts, which the author has collated, are anything more than what is commonly taught beginners in embryology, (5) nor to recognize that they afford any arguments to support the author's theory of 'antithetic alternation.'"

As regards the heading 1, the reviewer is apparently unaware of the existence of the completed part of my work published in April, 1896, in the Zool. Jahrb. under the title, 'The history of a transient nervous apparatus in certain Ichthyopsida—an account of the development *and degeneration* of ganglion cells and nerve-fibres.'

The work contains some of the results of six years' investigation of the matter; it was carried out on upwards of 120 embryos (out of a collection of 500 or more), whose sizes ranged from 5 mm. to 19 cm., and it is illustrated by 8 double plates containing more than 131 figures. I assert, and challenge your reviewer to prove the contrary, that in the work in question *the whole of the transformations* of these cells *to their complete degeneration* are described, illustrated and established. I have asked many competent embryologists what was their opinion on this point, and not one of them expressed anything but the conviction that I had completely established the transient nature of the ganglion cells. Hence I conclude that the reviewer must have been dreaming when he wrote "it may be questioned whether *a failure to study the fate of certain cells* in an embryo is a sufficient basis to construct a revolutionary theory upon." When I wrote my work upon them I had *only studied them for six years!*

(2) No such foolish idea as that mentioned in the review, to wit, that 'the whole *embryo* is a transient structure,' has ever entered my head as any time. What I believe, and what I have written more than once, is that there is in the development of every vertebrate a more or less reduced larva or '*phorozoon*' of a transient nature, that an embryo or sexual generation could be transient has never yet occurred to myself, or to anyone else, so far as I am aware.

(3) This is supposed to be a criticism on what I have discribed as the 'critical stage' or phase. The reviewer considers that there is no new discovery in this, but he adduces no evidence for his belief, that it is 'a well known fact,' and that what I have brought forward is nothing more than what is taught beginners in embryology.

If it be a well-known fact, this existence of a corresponding period in the development of vertebrates, and (4) if the facts I have described be such as are usually taught beginners in embryology, surely there must be evidence of it in some of the text-books of embryology. There is certainly no evidence of this 'well-known fact' in the *literature* of embryology, beyond the few lines I have cited from His regarding the human embryo, and, although I am pretty well acquainted with the more important current text-books, I have never been able to find anything in any of them, not excluding Minot's volume, bearing on the matter.

Why, moreover, within the past few years, should Keibel and Oppel, who are well versed and skilled, working and teaching embryologists, have spent so much time and labor in searching for corresponding phases in embryos of different vertebrates, and why should they have failed to find my critical phase, if it were already known to exist? Founding on these researches and my own, I state that there is only one such corresponding phase in the development and that it was first described in the pamphlet under consideration. If your reviewer questions the truth of this, let him produce his evidence. I believe, and the contrary has still to be proved, that my pamphlet contains the following novelties, fate of the yolk, yolk-sac and merocytes, discovery of a corresponding critical phase in the development of

various vertebrates, explanation of the premature birth of the opossum, the main outlines of the history of the mammary glands and placenta and a number of other items.

It was published and appeared as a separate work, because it was felt that the facts described were sufficiently novel and important to warrant such a course, and not merely 'to secure attention' to my theory. The 'note of personal exultation' is no such theory; it is intended to be an invitation and challenge to scientific men to examine and, if possible, to refute my arguments. The latter is something the reviewer has carefully avoided to attempt.

The last paragraph cited (5) is merely the expression of the critic's personal opinion and, unless supported by argument, can carry no conviction. The reviewer offers no reasons for his adverse judgment; until he does so, it is out of question to consider, or even to understand, what standpoint he takes up. A mere denial of the truth of my theory is not argument, but dogmatism.

J. BEARD.

UNIVERSITY OF EDINBURGH.

MR. BEARD'S paper on the transient nervous system was well known to me, and I consider my statements correct, and I made them deliberately. There are two methods, and only two, that enable the investigator to trace the forms and connections of nerve-cells, the Golgi method and the methylen-blue method. Mr. Beard employed neither of these, and, as a matter of fact, has not traced, and was necessarily unable to follow, all the essential transformations of these cells. His research is an extremely interesting one, and, in my opinion, important, but the results are not available in support of the 'Phorozoon' theory. The number of embryos and of years devoted to the research do not make up for the exclusive use of an insufficient method.

The facts referring to the condition of the organs at the 'critical stage' are given more or less fully in all embryological text-books. The occurrence of the critical stage is not specially mentioned, because no embryologist, except Beard, has heretofore regarded it as more or less important than preceding and subsequent stages. The error of Mr. Beard's, which I note, is the assumption that this stage is 'critical,' for stages before it and after it could equally well be selected and traced through the vertebrate series as accurately as the 'critical' stage. If Mr. Beard knows the contrary of this he must have compiled the characters of various classes of vertebrates at other stages and found that they do not agree. The detailed publication of such a compilation must precede a claim for serious attention to his hypothesis. As stated in the notice of Beard's work, the compilation of characteristics in vertebrate embryos of various classes and all approximately at the same stage is useful, and if corresponding tables of other stages were also compiled they would also be useful. It would be interesting to know what proof establishes the 'critical' nature of the stage selected by Mr. Beard. He has not as yet published any such proof, although the *onus probandi* is his. He calls for disproof, but proof from him must come first. Mr. Beard states that he compiled the facts, yet complains that I say the facts are well known. Does he mean that the facts he quotes from various authors were unknown? My review is a protest against two tendencies: first, to solve, embryologically, morphological problems without sufficient regard to histogenesis; second, to push speculation indefinitely beyond observation. Both tendencies have been marked in Mr. Beard's previous papers, as well as in the one under discussion.

I regret that my criticism cannot be more favorable.

CHARLES S. MINOT.

SCIENTIFIC LITERATURE.

The Survival of the Unlike. A collection of Evolution Essays suggested by the study of domestic plants. By L. H. BAILEY. New York, The Macmillan Company. 1896. 515 pp. 8vo.

Whatever Professor Bailey writes is interesting reading. He has the rare gift of an entertaining style, and what he writes people want to read. All his previous books have been widely read, and this will prove to be no exception to the well-established rule. The secret of this popularity, if there be any secret about it, is that when he writes he has some-

thing new to say, something based upon experiences and observations. These are by no means all his own, for he has the ability to see with the eyes of other people, as well as with his own. He is thus able to bring into his pages a rich mass of new matter which gives them additional interest and value.

This new book consists of essays and papers, all of which have been presented elsewhere and are now brought together in accordance with the author's plan. Thus, while a collection of essays, it is not without unity. "In making these essays," the author says in his preface, "I have constantly had in mind their collection and publication, and have therefore endeavored to discuss the leading problems associated with the variation and evolution of cultivated plants, in order that the final collection should be somewhat consecutive."

The following sentences from the preface will give the reader a general idea of the author's position. "The underlying motive of the collection is the emphasis which is placed upon unlikenesses, and of their survival because they are unlike. The author also denies the common assumption that organic matter was originally endowed with the power of reproducing all its corporeal attributes, or that, in the constitution of things, like produces like. He conceives that heredity is an acquired force, and that, normally or originally, unlike produces unlike." The author's *a priori* reasons for belief in the hypothesis of evolution are "the two facts that there must be struggle for existence from the mere mathematics of propagation, and that there have been mighty changes in the physical character of the earth, which argue that organisms must either have changed or perished." On the other hand, "the chief demonstrative reason for belief in evolution is the fact that plants and animals can be and are modified profoundly by the care of man."

The body of the book is in three 'parts,' the first including essays touching the general fact and philosophy of evolution; second, those expounding the fact and causes of variation, and third, those tracing the evolution of particular types of plants. The first essay gives name to the book. In it the author discusses (1) the nature of the divergences of plants and animals, suggesting the *Mycetozoa* as the point of divergence; (2) the origin of differences, holding that all plants and animals came from one original life-plasma which had the power of perpetuating its physiological but not its structural identity; no two organisms ever being exactly alike, it follows that unlike produces unlike; (3) the survival of the unlike, this being an extension of our notion of the meaning of the phrase 'the survival of the fittest,' by showing that the fittest are the unlike.

The author gives us some interesting pages on the species dogma, in which he pointedly shows the inconsistency of those who demand experimental evidence of the evolution of a species, and yet reject 'horticultural species' because they have been produced under cultivation. Many examples are given of the origination of well-marked 'varieties,' which are more different from the species from which they sprung than are the recognized species from one another. Here Professor Bailey's experience as a horticulturist enables him to cite striking examples of what the candid reader must admit are good species evolved through man's selection. Thus we seem to have made species of of beans (*Phaseolus*), tomato (*Lycopersicum*), maize (*Zea*), soy-beans (*Glycine*), etc. The horticulturist who is familiar with the plasticity of plants, and who is accustomed to see new and persistent forms arise, cannot help being an evolutionist, nor can he help being impatient with the botanist who refuses to accept such forms as true varieties or species, as much entitled to recognition as those whose origin we do not happen to know.

Charles E. Bessey.
The University of Nebraska.

A Popular Handbook of the Ornithology of Eastern North America. By Thomas Nuttall. 2d Revised and Annotated Edition, by Montague Chamberlain. With additions and 110 illustrations in colors. Vol. I., The Land Birds. Vol. II., Game and Water Birds. Boston, Little, Brown & Company. October, 1896.

For more than half a century students of North American ornithology have had three works which by common consent came to be

regarded as classics. To lovers of birds the names of their authors, Audubon, Wilson and Nuttall, are as familiar as those of Milton, Dante and Shakespeare. Nuttall's book was the less pretentious of the three, having no colored plates and selling at a price which brought it within reach of a large constituency.

Nuttall was primarily a botanist, and not a few of his admirers who know him only from the excellence of his ornithological writings will be surprised to learn that for about ten years (1825–1834) he was Curator of the Botanic Garden and lecturer on natural history at Harvard, being Asa Gray's predecessor; and that the high character of his work placed him in the front rank of early American botanists.

In seeking new plants he made an expedition into Arkansas, and afterward, in company with Capt. Wyeth and J. K. Townsend, crossed the continent from Atlantic to Pacific, following the difficult overland route later known as 'The Oregon Trail.' His field work led him into all sorts of out-of-the-way places where he was constantly meeting strange and interesting birds. That he took an affectionate interest in their doings is shown by his biographies, which are original, faithful and entertaining and show an intimate personal familiarity with the species of which he wrote. Besides, they furnished what was then so much needed, a brief narrative of the life history, breeding habits and distribution of each as at that time known. In speaking of the book a modern writer has said: "Nuttall, like good wine, does not deteriorate with age." The original edition was long ago exhausted and for many years has commanded a relatively high price—the two volumes commonly selling for $25, or even $30.

In order to keep this execellent work within reach of the ever-increasing number of students and lovers of birds, Mr. Montague Chamberlain brought out, in 1891, a new and revised edition. The new edition differed from the original in several important respects: While the text and squence of the biographies were in the main unchanged, the birds were given their modern names, Western species were omitted, the descriptions of species were rewritten, a paragraph was added giving the geographic range as at present known, and additional species were included so as to embrace all the birds now known from the eastern United States and Canada. In all cases, the additional matter was printed in different type from the body of the work, so that Nuttall's original text was clearly set off from the matter contributed by the editor. The title page was misleading, as it failed to indicate the fact that the Western species had been left out, but in the new edition (1896) this is corrected, the new title page reading: 'A Popular Handbook of the Ornithology of Eastern North America.' The book is printed from the same plates as the previous edition, but corrections and additions have been made in the matter contributed by the editor. It is illustrated by text figures and colored plates. The latter might better have been omitted, although it is true that the majority of them may be recognized if looked at through a veil or smoked glass to deaden the unnaturally brilliant colors so characteristic of cheap chromolithographs. It is only fair to the author to state that he is in no way responsible for these plates; they were introduced by the publishers against his desire. The text figures are much better. They are of two kinds: (1) cuts borrowed from Baird, Brewer and Ridgway's History of North American Birds and mostly of high excellence; and (2) figures drawn for the book and mostly unsatisfactory. The latter have a coarse look and evidently were intended for greater reduction; they suffer by contrast with the more finished drawings among which they are scattered.

Mr. Chamberlain has done a public service in enabling the younger generation of bird students to add this classic to their libraries. This will be especially appreciated by those who care more for a bird in the bush than a bird in the hand—who love birds for what they are and what they do in life—for Nuttall's biographies possess a freshness and charm which time can never efface. C. H. M.

The Cell. Outlines of General Anatomy and Physiology. By DR. OSCAR HERTWIG. Translated by M. CAMPBELL and edited by H. J. CAMPBELL, M. D. London, Swan, Sonnenschein & Co.; New York, Macmillan & Co. 1895. 8vo., cloth, 368 pp., 168 figs. $3.00.

The Cell in Development and Inheritance. By Edmund B. Wilson, Ph. D., Professor of Invertebrate Zoology, Columbia University. New York and London, Macmillan. 1896. 8vo, cloth, 371 pp., 142 figs. $3.00.

These two recent books on the same subject by well known investigators, the one in Germany, the other in America, serve to mark a new stage in the differentiation of the biological sciences—the separation of cytology from histology as an independent science. Although, as their titles indicate, they attempt to cover much the same ground, they show a marked dissimilarity in several respects—a dissimilarity which it is worth while to emphasize.

First, however, a word as to the common ground covered. Both consider especially the structure and chemical composition of cytoplasm and nucleus, the phenomena of cell-division, the germ cells in their development and union, and the theories of inheritance from the cytological standpoint. Both works give full bibliographical references.

The most important difference between them arises from the fact that Wilson's work was written three and a-half years after Hertwig's. Wilson is thus able to use the results of the extraordinary activity in cytological research which has characterized the last third of a decade. Aside from this, the standpoint of the authors is slightly different, for Hertwig devotes nearly a third of his book to the results of experimental physiological study on the cell, while these are only incidentally considered by Wilson. Thus only in Hertwig's book do we find a systematic discussion of protoplasmic movement and the phenomena of irritability, metabolism and formative activity. Wilson, on the other hand, discusses more fully certain matters of recent observational study, such as the origin of the tetrads and reduction of the chromosomes. Thus while the scope of Hertwig's work is broader, Wilson's is more recent and more thorough as concerns cell morphology.

The general method of presentation of the subject in Wilson's work is in the highest degree pleasing. It retains the impress of its origin in a semi-popular course of lectures, which makes it easy reading, while the style is clear and interesting—qualities too rarely found in technical works. Each topic is usually begun with a general outline of our present knowledge of the matter, and this is followed by a more detailed and critical presentation of the facts. The historical method of developing the subject is not usually adopted, for this does not lend itself well to the needs of a text-book on a descriptive science.

Hertwig, on the other hand, has a rather heavy, colorless style, and in the translation all of the faults of the original are exaggerated. Indeed, the work has suffered terribly in the attempt to dress it in a new language. An example or two must be given. Thus Hertwig says, very truly, that the latent properties of the cell which become evident only during development "nennt man [in Germany] Anlagen." What, on the other hand, will be the astonishment of the cytological reader of the translation to learn (page 335) that [presumably by the English-speaking cytologists] they are called *fundamental constituent attributes!* In other places the translator appears as ignorant of German as of biology. Thus in one place Hertwig says: "Eine tiefere Bedeutung gewannen diese Thatsachen aber erst, als am Ende des 18. Jahrhunderts sich eine mehr philosophische Betrachtungsweise der Natur Bahn brach." This might be translated thus: These facts [of the cell] did not acquire a deeper significance, however, until the end of the eighteenth century, when a more philosophical manner of regarding nature began to predominate. The translator makes it read (page 2): "Much greater importance, however, was attached to these facts after the investigations, which were carried on in a more philosophical spirit by Bahn [!] towards the end of the eighteenth century, were published." It is unnecessary to state that the philosophic 'Bahn' does not figure in Engelmann's Bibliotheca. Numerous other instances might be given of sentences in which the original meaning is wholly distorted and which are even, in themselves, meaningless, and scores of others in which the greatest liberties have been taken with the original, causing the author to say what he certainly would have avoided saying. The translation is, on the whole, wretchedly done, and bad and

good are so intermingled that the uninitiated reader cannot know what is reliable and what is false.

While Wilson's book leaves little to be desired in respect to careful statement, there is one ground for serious regret, namely, the omission of reference to certain important American papers. We may excuse this in a foreigner, but not in an author in Prof. Wilson's position. Thus, Kofoid's papers upon cleavage in Limax are not referred to in the whole book, yet he first called attention to the failure of Balfour's law referred to on page 273. Also his contributions to the laws of spiral cleavage are of the first importance.

A comparison of the press work of the two books reveals as great a difference as the matter. For in the translation of Hertwig the type is small and worn and the numerous half-tone reproductions are frequently muddy—like the translation. On the other hand, the type in Wilson's book is beautifully clear and the figures, which are nearly all new to text-books, are all that could be desired. The work is indeed a model in the beauty of its illustrations.

While it is impossible to summarize such a book as Wilson's, yet a few of its salient features and conclusions on debated questions may be mentioned. Especially noteworthy are the Table showing the number of chromosomes in germ and somatic nuclei of various animals, and the Glossary, which gives the authors and dates of introduction of each term. Although treating fully Bütschli's view of the honeycomb structure of protoplasm, the author believes (page 19) that the fibrillar structure is the more typical. All the organs of cell-division—centrosome, spindle and chromosomes—are to be regarded as differentiations of the primitive nuclear structure (page 67). His conclusions concerning the factors determining development are clearly stated on page 323 as follows: "Development may thus be conceived as a progressive transformation of the egg-substance primarily incited by the nucleus, first manifesting itself by specific changes in the cytoplasm, but sooner or later involving in some measure the nuclear substance itself. * * * Cell-division is an accompaniment, but not a direct cause of differentiation. The cell is no more than a particular area of the germinal substance comprising a certain quantity of cytoplasm and a mass of idioplasm in its nucleus." These quotations may serve to show that the book is written on broad lines. It certainly takes rank at once among the most important biological works of the period, and it is a book of which its publishers and all Americans may well be proud.

C. B. DAVENPORT.
HARVARD UNIVERSITY.

Physiological Papers. By H. NEWELL MARTIN. Dr. Sci., University of London; A. M., University of Cambridge; M. B., London University; M. D. (Hon.), University of Georgia; late Fellow and Lecturer in Christ College, Cambridge; Fellow of University College, London; Fellow of the Royal Society; Professor of Biology, Director of the Biological Laboratory and Editor of the Studies from the Biological Laboratory, Johns Hopkins University, 1876–1894, and Professor of Physiology in the Medical Faculty of the same. Memoirs from the Biological Laboratory of the Johns Hopkins University III. Baltimore, The Johns Hopkins Press. 1895.

The book before us is intended to commemorate the connection of Prof. Newell Martin with the Johns Hopkins University. In it are reprinted his physiological papers published from the Biological Laboratory created by him there, and some of the public addresses delivered by him on various occasions in this country. The whole forms a handsome quarto volume, valuable not only from its commemorative significance, but also as uniting conveniently for study and reference a series of important and interesting contributions to medical and biological science.

From the physiological point of view, especially at the present time when the investigation of the isolated mammalian heart is being actively renewed, most interest attaches to the papers in which Prof. Martin described the evolution of what he himself termed the Baltimore method for the isolation of the mammalian heart, and many of the most important results obtained with it. The mutual influence exercised on one another by the dif-

ferent parts of the mechanism by which the mammalian circulation is carried on, and the functional connection of all of these by means of the nervous system with all the other organs of the body, often render difficult, sometimes impossible, the drawing of reliable conclusions as to the direct effect of any agency on the heart itself from experiments on the whole organism. Here, therefore, was especially a case for the application of the physiological method of isolation: the separation of a given organ from all its functional, if not anatomical, connections; and keeping it alive, in spite of this separation, by the artificial maintenance of the necessary conditions of continued vital activity in the case of warm-blooded animals—a suitable temperature and a sufficient and constant supply of arterial blood. With an organ thus isolated the determination of the *direct* influence upon it of various factors can relatively easily be certainly determined.

The isolation of the mammalian heart, which Carl Ludwig and Alexander Schmidt had found impossible in 1868, was first accomplished by Newell Martin in 1881. In order to secure arterialization of the blood sustaining the nutrition of the heart, the lungs, rhythmical inflation of which was artificially kept up, were left in functional connection with it. The remaining organs of the body, deprived of their normal blood supply soon die, the heart, however, continuing to beat in a perfectly normal manner for so long as five hours and more, although deprived of all influence of the central nervous system. The pressure under which venous blood flows into its right side can be varied by changing the height of the reservoir containing this, as can also be the pressure under which the left ventricle empties itself by alterations in the height of the outlet connected with it.

With the aid of this method, modified in details as circumstances required, various important fundamental questions in the physiology of the mammalian heart were attacked and solved in the Baltimore laboratory. Most of the communications describing the results of these researches are contained in the present volume, Prof. Martin having been author or joint author of them.

Their titles are: 'A New Method of Studying the Mammalian Heart;' 'The Influence upon the Pulse Rate of Variations of Arterial Pressure, of Veinous Pressure, and of Temperature;' 'Observations on the Direct Influence of Variations of Arterial Pressure upon the Rate of Beat of the Mammalian Heart;' 'The Direct Influence of Gradual Variations of Temperature upon the Rate of Beat of the Dog's Heart' (this formed the Croonian Lecture of the Royal Society for 1883); 'The Action of Ethyl Alcohol upon the Dog's Heart;' 'Experiments in Regard to the Supposed Suction Pump Action of the Mammalian Heart,' and 'On the Temperature Limits of the Vitality of the Mammalian Heart.' It is of distinct historical importance that in this last investigation, in which E. C. Applegarth took part, it was found possible to isolate the heart and keep it alive independently of the lungs, the blood being aerated simply by air bubbling through it. The recent work of Langendorff in Rostock on the isolation of the cat's heart without the aid of the lungs was thus essentially anticipated.

The other original investigations described in the volume are mostly concerned with the respiration. They include Martin's elaborate research on of the respiratory movements of the frog and their nervous mechanism, and the study of 'The Influence of Stimulation of the Mid-Brain upon the Respiratory Rhythm of the Mammal,' in which W. D. Booker was collaborator, the results obtained being later confirmed by Christiani in Berlin. Martin's valuable contribution to the question whether the internal intercostal muscles are to be regarded as inspiratory or expiratory in function, his decision being in favor of the latter alternative, is, of course, also given.

Those of Newell Martin's public addresses on more or less general subjects included in this volume well deserved to be so. They are all admirably written and are most stimulating reading. Martin was a strenuous advocate of the justifiability of vivisection, and in several of his addresses made most powerful pleas for it. A passage such as the following is perhaps more worth quoting in America at the present time than when it was first written:

"It is not mere physical suffering that we

labor to diminish. We labor to save *life—human life* with all its ties. Were I to see a man tortured with facial neuralgia, and knew that I could relieve him by inflicting equal pain on a dog or horse, I hardly know what my decision would be. I suppose I should decide in favor of the man. But that is not the question which faces our profession in regard to experiments on animals; it is how we may better our knowledge and increase our power to save the life of husband and father—of wife or mother—of the child in whose life the hearts and hopes of its parents are bound.

"Certain of our opponents have their sympathies greatly excited by the occasional cry of a dog enduring pain from pharmacological experiment. Have they listened to the wail of the new-made widow? Some of them use their fiercest invective to calumniate those who have kept animals alive a few days after an experiment, that the causation of disease may be better understood and its prevention made possible. Have they realized the years of penury and misery too often the lot of the orphan? They have not felt personal responsibility for the life of the bread winner, or they would surely say with us, kill a hundred, kill a thousand animals if you have any reasonable hope of thereby preserving to one wife her husband, to one child its mother." (p. 254.)

Since the greater part of the above was written, the unexpected news of Newell Martin's death has come from England Our consolation for the relatively early loss of so brilliant a physiologist can only be that in the time given to him for scientific work he obeyed his own exhortation at the close of the lecture inaugurating the biological work of the Johns Hopkins University: "Let us, then, each work loyally, earnestly, truthfully, so that when the time comes, as it will come sooner or later, in one way or another, to each of us, to depart hence, we may carry with us a good conscience, and be able to say that in our time no slipshod piece of work ever left the laboratory; that no error we knew of was persisted in; that our only desire was to know the truth. Let us leave a record which, if it perchance contain the history of no great feat in the memory of which our successors will glory, will at least contain not one jot or one tittle of which they can be ashamed."

The isolation of the mammalian heart will always remain one of the triumphs of experimental physiology. F. S. LOCKE.

HARVARD MEDICAL SCHOOL.

Anleitung zur Mikrochemischen Analyse der wichtigsten Organischen Verbindungen. Von H. BEHRENS, Professor an der Polytechnischen Schule zu Delft. Zweites Heft. Leopold Voss, Hamburg und Leipzig. 1896. 106 pp.

The second part of Behrens' text-book of microchemical organic analysis deals with the important fibres: those of woven goods; wool, silk, cotton, linen, hemp, jute and others; and those of paper; the cellular fibres of straw, alfalfa and wood. The microchemical study of these substances with reagents and in polarized light, and methods for examining woven goods and paper, complete the book. It is well printed and illustrated and a complete work in itself. Besides the illustrations in the text, three beautifully colored plates reproduce the appearance of the different fibres in polarized light and when stained with different dyes. It is well to remember that Prof. Behrens is not only an authority on this subject, but is the only authority for the student, as he has written the only text-books. The organic analysis is a worthy continuation of the author's inorganic analysis.

E. R.

SOCIETIES AND ACADEMIES.

CHEMICAL SOCIETY OF WASHINGTON.

THE 91st meeting of the Society was held Thursday evening, December 10, 1896. The President, Dr. de Schweinitz was in the chair, with thirty members and several guests present.

The first paper of the evening was by Prof. H. W. Wiley on 'The Mechanical Analyses of Phosphatic Slags.'

The second paper was by Prof. Charles E. Munroe, entitled 'An Early Specimen of Gun Cotton.' Prof. Munroe called attention to a sample of gun cotton which he had received from Dr. W. A. Hedrick, some two years ago, and which had been for many years

in the possession of Dr. B. S. Hedrick, formerly Examiner in the U. S. Patent Office. The specimen was in the form of a cartridge, consisting of long staple gun cotton, and although the paper was torn somewhat it was still possible to read that it was labeled 'cotton for shooting,' and that it was made by 'Lennig, of Philadelphia, under patent of October 6, 1846.'

The gun cotton is in a complete state of preservation and, as it apparently dates from shortly after Schoenbein's patent was filed, it is probably the oldest specimen in this country and shows that properly made gun cotton is a stable product. Prof. Munroe then offered in the same connection a copy of Schoenbein's original United States patent, and discussed his claim to being the original discoverer of gun cotton, holding that although he had much improved the process of manufacture, and made it practicable, that Braconot Pelouze and Dumas, had all preceded him in producing an explosive, cellulose nitrate. There was some discussion, especially as to a discrepancy between the dates of the patent and that on the specimen presented by Prof. Munroe.

Dr. W. J. Hedrick referred to the connection of his father with the Patent Office, and said that formerly the laboratory of the Agricultural Department, which was then under the Interior Department, was connected with the Patent Office, and that the specimen might have come from this laboratory. Dr. Littlewood said that he had tried to obtain further data, but had found no explosives in the office as old as this specimen. He further stated that few would be handed down by him to his successor, as his policy was to remove all explosives as soon as possible. Mr. Dewey said that he would not put much faith in the date on the specimen. Lennig may have made a mistake in the date. He was sceptical as to its age. Prof. Munroe said that if it dated back only to 1860 it was old. After further discussion by Dr. Fireman and Prof. Munroe, Mr. W. D. Bigelow gave a description of a 'Convenient Apparatus for the Estimation of Urea in Urine by the Hypobromite Method.' The apparatus consisted of a burette so bent that the graduated part forms the arc of a circle, the center of which is a lip at the end farthest from the stop cock. Above the stop cock is a thistle-tube top for the introduction of the reagents.

A. C. Peale,
Secretary.

Texas Academy of Science.

The mid-year meeting of the Texas Academy of Science was held in San Antonio, December 31, 1896.

At the afternoon session the following papers were read: 'Notes on the Physiology of the Central Nervous System of some of the Lower Amimals,' by W. W. Norman, professor of biology in the University of Texas. 'The Evolution of Culture,' by Thomas Fitzhugh, professor of Latin, University of Texas. 'Vertical Curves for Railways,' by J. C. Nagle, professor of engineering, Agricultural and Mechanical College of Texas. 'Notes on Indian Corn and some of its Uses Among Modern and Ancient Mexicans,' by Dr. David Cerna, Medical Department of the University of Texas.

The chief event of the evening session was the address of Maj. C. E. Dutton, U. S. A., on 'The Economics of Concentrated Capital.' Dr. George Bruce Halsted, President of the Academy, also spoke briefly on 'The Greatest Foundling House of the World, a Personal Study in Russian Sociology.'

Dr. Cerna had the pleasure of presenting to the Academy, Mrs. Frances Long Taylor, a daughter of Dr. Crawford W. Long, of Georgia, the well known discoverer of the anæsthetic properties of ether.

At the close of the meeting the members of the Academy were entertained by Major Dutton at his residence.

Frederic W. Simonds.

NEW BOOKS.

Catalogue des bibliographies géologiques. Emm. de Marjorie. Paris, Gauthier-Villars et fils. 1896. Pp. xx+733.

Life and Letters of William Barton Rogers. Edited by his wife, with the assistance of Wm. T. Sedgwick. Boston and New York, Houghton, Mifflin & Co. 1896. Vol. I, viii+427; Vol. II., vi+451. $4.00.

Problems of Biology. George Sandeman. London, Swann, Sonnenschein & Co.; New York, The Macmillan Co. Pp. 213. $2.00.